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„Effects of the Covid-19 pandemic on the gender wage gap“

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Abstract (English)

The motivation for this work is to deliver empirical evidence of a changing of the gender wage gap due to the indirect effects of the Covid-19 pandemic on female wage-earning capabilities in Germany. While the gender wage gap has been narrowing in recent years, the aggregate shock of the Covid-19 pandemic to the labor market may have stalled or reversed this trend. This is due to the deterioration of gender-specific predictors of labor market outcomes for women caused by developments associated with the Covid-19 pandemic. By conducting a multivariate regression analysis on the SOEP-CoV data, the idea is to deliver scientific insights on the developments of the gender wage gap caused by the Covid-19 pandemic. While research suggests an amplifying effect on pre-existing predictors of wage discrimination and thus a disproportionally disadvantaged female wage equality in the long-run, this work will also present evidence that hints towards a positive development of the gender wage gap due to more flexibility and changes in domestic work patterns.

Abstract (Deutsch)

Die Intention dieser Arbeit besteht darin, empirische Beweise für eine Veränderung des geschlechtsspezifischen Lohngefälles, des Gender Wage Gaps, zu liefern, die auf die indirekten Auswirkungen der Covid-19-Pandemie auf die weibliche Erwerbsfähigkeit in Deutschland zurückzuführen sein könnte. Während sich das Lohngefälle zwischen den Geschlechtern in den letzten Jahren verringert hat, könnte der volkswirtschaftliche Aggregatschock der Covid-19-Pandemie auf dem Arbeitsmarkt diesen Trend gestoppt oder umgekehrt haben. Dies ist auf eine potenzielle Veränderung der geschlechtsspezifischen Prädiktoren für die Arbeitsmarktergebnisse von Frauen zurückzuführen. Durch die Durchführung einer multivariaten Regressionsanalyse der SOEP-CoV-Daten soll diese Annahme validiert werden. Während die bisherige Forschung zu diesem Thema einen verstärkenden Effekt auf bereits bestehende Prädiktoren der Lohndiskriminierung nahelegt und somit die Lohngleichheit von Frauen benachteiligt sieht, wird diese Arbeit auch Belege für eine positive Entwicklung des geschlechtsspezifischen Lohngefälles aufgrund von mehr Flexibilität und Veränderungen in den häuslichen Arbeitsmustern präsentieren.

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List of abbreviations

Covid-19	-	Coronavirus disease 2019
STW	-	Short-term work
SOEP	-	Socioeconomic panel
WFH	-	Working from home
WHO	-	World Health Organization
DIW	-	Deutsches Institut für Wirtschaftsforschung
STEM	-	Science, technology, engineering, mathematics
FSWE	-	Firm size wage effect
SME	-	Small, medium enterprises

1. Introduction

1.1 Problem statement

The Covid-19 pandemic and the associated governmental countermeasures of curfews, social distancing, and lockdowns are perceived to have had an immense effect on the life of German citizens. There is, however, a huge difference between being infected and being affected by the Covid-19 pandemic (Burki 2020). Apart from the health crisis that erupted, the secondary economic shifts in society gave rise to vast research on their implications on gender inequality (Czymara et al. 2021). The initial observation supports the theory that women will strongly feel the negative effects of the pandemic in many social and economic dimensions in a disproportionate fashion (Paz et al. 2020; Fortier 2020). A pressing issue here is the evolvement of the gender wage gap under the effects of the Covid-19 pandemic.

The unequal distribution of income between men and women, the gender wage or pay gap and its determinant factors have already been a prime subject of research in gender inequality studies before the onset of the Covid-19 pandemic (Ponthieux and Meurs 2015). In the year 2019, the gender wage gap in Germany was estimated to be around 20%, meaning that for every Euro a man earns, a woman only earns 80 Cents. After controlling for individual heterogeneity, the unexplained wage gap still amounted to a 10% wage penalty for women, which is based on discriminatory practices (Skora et al. 2020). Within traditional gender wage gap research, certain trends, explanations and evidence have provided a scientific canon that will now be expanded due to the developments associated to the Covid-19 pandemic (Alon et al. 2020). In a paper from 2017, Blau and Kahn have summarized the current state of the art concerning the gender wage gap that is now challenged by recent developments. There are some common themes in terms of explanations for the gender wage gap that have provided the fundamentals for this area of research up until this point. Among the traditional explanatory variables, there is the labor force participation, differences in human capital and working hours, gender division of labor and motherhood in the home as well as the choice of occupation, industries and firms (Blau and Kahn 2017).

In relation to these explanatory factors, there have been published a multitude of papers that address the change of the gender wage gap predictors with different aspects of the Covid-19 pandemic, like changes in employment of certain sectors, work schedules or

variations in family care responsibilities (Alon et al. 2020; Bonacini et al. 2020; Thomason and Macias-Alonso 2020). While these scientific works certainly do provide a poignant insight on isolated issues, they often disregard the interference between them and have yet to create a clear empirical status quo of the gender wage gap post-Covid-19.

1.2 Methodical approach

This paper aims at providing evidence to the theory that the predictors of the Covid-19 pandemic concerning the gender wage gap are interlinked and thus might pose a serious regression to gender wage equality. It further aims to deliver empirical evidence on the quantitative extent of these effects by comparing panel data from the 2019 Socio-economic Panel (SOEP) study, which has been collected by the German Institute for Economic Research (DIW) with data from the SOEP-CoV study which has been specifically sourced in 2020 during the peak of the pandemic. The gender pay gap had already been present before the pandemic and government containment measures struck and has likely changed in the last months. It is therefore paramount to (I) summarize these granular assessments, (II) put them into contrast with works on the classical gender wage gap theory and (III) create a clear empirical assumption about the true scope in which the Covid-19 pandemic has influenced the gender wage gap.

The hypotheses that emerge from the literature research hint at a strong catalytic event, where the implications of the Covid-19 pandemic on the labor market strongly interrelate with underlying determinants of the gender wage gap. Amplifying these determinants, the pandemic is suspected to have a very strong, disproportionate effect on women that might have worsened their already disadvantaged situation concerning equal wages. They will be answered by identifying the determinants of the gender wage gap, contrasting these findings with the already discovered ramifications of the Covid-19 pandemic, formulating hypotheses that link these two concepts and finally delivering empirical evidence by surveying the data. For example, a correlation between developments in e.g. sectors of female-dominated employment, changes in care needs in the household and changes in wages is surveyed. This should help to validate the hypothesis that Covid-19 might have had a catalytic, interdependent effect on female income and hence could have widened or at least stalled the reduction of the gender wage gap.

2. Theoretical background and related literature

To further explore this issue, a theoretic framework must be laid out carefully to create a sound foundation upon which the research and methodic approach of this work will be constructed. To create a common denominator, it is viable to understand the traditional approach to research of the gender wage gap. Literature will be provided in the first section that explains how the gender wage gap is derived by explanatory factors, how it is composed and how it can be measured. In the second section, these findings will be contrasted with the scientific work that focuses on the manyfold effects of the Covid-19 pandemic on the gender wage gap. This will then allow the research to bring forth a hypothesis as to how these subject matters correlate and create the framework for the empirical model.

2.1 History and development of the gender wage gap

The 1957 work of Becker on the 'economics of discrimination' pioneered the thought that if we observe the wage rate of two groups with the same productivity, there should be no difference between the two. If a difference can still be observed, it constitutes the wage gap that is accounted for by discrimination against one group (Becker 2010). This result has sparked countless further empirical studies on discriminatory wage gaps between races, ethnic groups and, in line with the approach of this work, genders (Oaxaca 1973; Blau and Kahn 1996; Böheim et al. 2013b; Böheim et al. 2013a). The main driver within the field of gender inequality research, especially the gender wage gap, has been the work of Blinder (Blinder 1973) and Oaxaca (Oaxaca 1973), which decomposes different labor market outcomes between groups such as genders or races into an explained part, hence productivity outcome predictors like education, working experience and firm tenure and an unexplained part, that can usually be attributed to some kind of discrimination (Jann 2008). The gender wage gap is, to some extent, an unexplained wage gap, where even though women and men do have the same abilities, education as well as skillset, they are compensated in a different, discriminatory manner by their employer (Montenegro 2001) . Special interest in gender wage differences has always been to observe and explain the evolution and the extent of the gap over time. Various studies have been conducted using longitudinal census data to create an accurate picture of whether equality policies have

taken fruit and the gender wage gap indeed has narrowed (Böheim et al. 2013a). Blau and Kahn have surveyed the Michigan Panel Study of income data to explain a falling wage gap despite unfavorable conditions for low wage workers, O'Neill and Polacheck provided insight into how the underlying factors of schooling and work experience contributed to the decline of the gender wage gap in the UK in the 1980's and Kunze shed light on how the gender wage gap transformed throughout the professional career (Blau and Kahn 1997; O'Neill and Polachek 1993; Kunze 2005). The overarching insight here has been that the gender wage gap has been narrowing, steadily but slowly, since the 1980s and that the main reason for that development has been the relative improvement of observable as well as unobservable characteristics concerning wage equality predictors that were mentioned in the introduction (Böheim et al. 2021).

2.2 Causes of the gender wage gap

Blau and Kahn have summarized the bulk of the research on the trends of the gender wage gap in their 2017 publication "The gender wage gap: extent, trends, and explanations". While they have identified a narrowing of the gender wage gap in the long term, they highlight that there have always been anomalies and unexpected trends in the short run, not unlike the developments during the Covid-19 pandemic that this paper aims to address (Blau and Kahn 2017). This observation coincides with the findings of Goldin from 2006, which constitute that there has been a quiet revolution in the gender wage gap by rising levels of female participation in the labor market, stronger career identification and changes in the marital fabric of society. The question of whether this revolution, how Goldin states it, "has been reversed or stalled" by Covid-19 shall too be answered in this paper (Goldin 2006).

Blau and Kahn divide the explanations of the gender wage gap into traditional or conventional factors, like education, working experience, industry and sector occupation as well as the division of labor and discrimination on the one hand, on the other hand, they delve into newer novel explanatory variables like social norms, psychological attributes as well as anti-discriminatory and family leave policies (Blau and Kahn 2017).

2.3 Human capital approach

Education, working experience as well as training are often grouped into a human capital explanation for the gender wage gap and are regarded by many as the most basic and approachable predictors. The argumentation behind this reasoning is that the individual combination of these factors within each participant in the labor market constitutes the productivity of a worker, that she or he is then able to sell to an employer at the market price. The accumulation of these traits is regarded as gender-specific and hence creates systemic differences in wage-earning capability (Otten 2020). This approach has proven to be a quite efficient variable in predicting the gender wage gap, as the differences in human capital investment between men and women can be explained quite simply. The incentive to invest in marketable training is attached to the expected lifetime working period, which due to childbirth and care is assumed to be lower for women. This renders them unable to benefit from higher wages, which are linked to accumulating consecutive work experience years and in turn decreases their appetite for human capital investments, resulting in lower wages over their professional life.

The narrowing of the gender wage gap in recent years due to higher female participation and subsequently more appetite for female human capital investments in the labor market has proven this assumption to be accurate (Polachek 2004). In addition, the theory assumes that women have a comparative advantage in the domestic sphere of work, while men have a comparative advantage in paid labor which often results in the traditional division of the gender roles of the household (Ruijter 2003). These works, among many others, are based on the work "Schooling, Experience and Earnings" published by Jacob Mincer in 1974 which is regarded as the benchmark model for the "human capital earnings function", which proposes the logarithm of earnings of wages as a function of years of education as well as working experience (Lemieux 2006; Mincer 1974). In the baseline model, there is a predictor for the return on wage for schooling or education and for human capital gathered on the job (experience), which is expressed as a squared function of labor market experience (Lauer 2000; Chiswick 2003).

$$\ln W_i = \ ß_0 + \ ß_1(schooling) + ß_2(experience) + ß_2(experience)^2 + \epsilon_i$$

This econometric specification by Mincer assumes that education and training or experience are production factors that are worth investing in, as the honing of skills and knowledge will result in a higher possible wage in the future (Bhatti 2013). This model has been modified, analyzed, and scrutinized because even though it is a cornerstone of labor market economics, new research and empirical proof have called for alterations, i.e. the estimation of returns of high school and college education as well as the non-separability of schooling and working experience. The more predictors are incorporated into the model, like nationality, age, occupational characteristics or working schedules, the smaller is the estimated gap in wage differentials (Böheim et al. 2013a). Concerning gender wage research, there is a development to account for expected work experience rather than potential working experience when applying this model. Studies that have applied the second, static proxy do not account for the intermittency of child birthing and rearing and are thus sometimes understating the importance of working experience in explaining the gender wage gap (Zveglich et al. 2019). So while the Mincer earnings function does provide a sound foundation, it is paramount to modify and consider the individual requirements of a study when using this instrument, as we will see later in the methods section.

A key variable within the framework of Mincer is the effect of schooling or education, as this is usually the first investment into human capital in an ordinary life. Here, the first selection into different types of human capital qualifications is usually undertaken as people select the type of schooling they attend in Germany, which will usually have a strong impact on their later labor market value. While in the classical model, Mincer would base the estimates on the number of years of education that a person has obtained in their lifespan, this will not always result in an accurate prediction. Especially, in the case of Germany, the different qualifications which are acquired by the pursuit of different degrees as well as the labor market anomaly that German employers prefer graduates that finish their education as fast as possible is cause for some important caveats (Reimer and Schröder 2006).

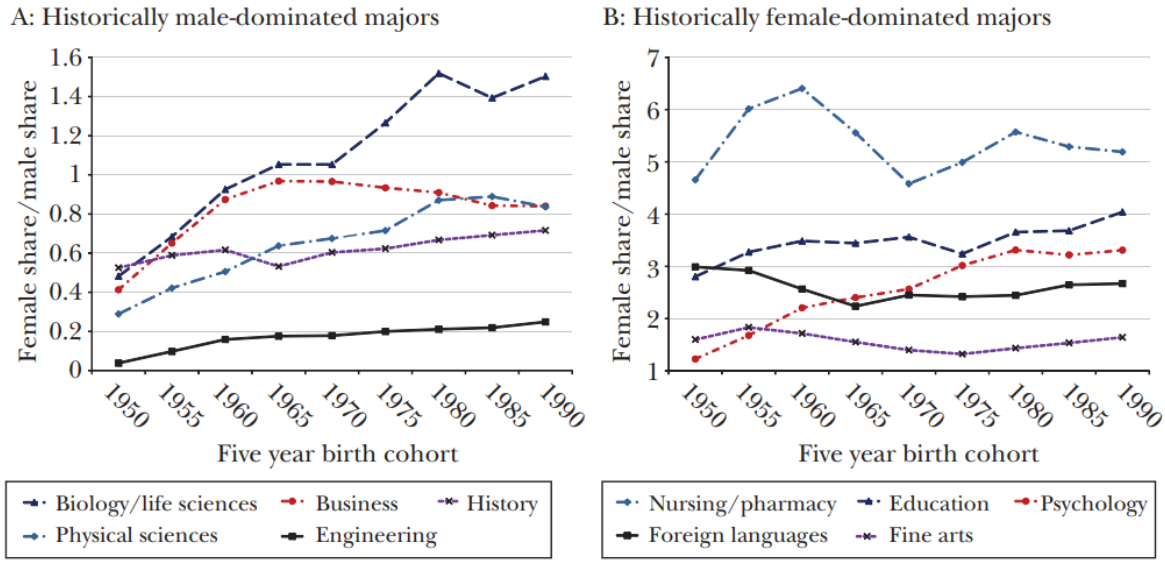
One can therefore separate three broad categories of education in Germany, with the lowest step leaving school with no degree at all or only the lowest achievable high school de-

gree (Hauptschule). The second level contains all high school graduates with a strong focus on graduates that pursue a practical education, such as an apprenticeship or vocational training. On the highest level, we have high school graduates that pursue a university or higher technical college education (Lauer 2000). Women earn less on each level, with the largest difference on the highest education level and a slightly better comparative wage in the lowest segment. And even though we can now witness more female than male graduates on the university level, male college graduates out earn women by about 20 percent after graduation, even when controlling for subject matter (Francesconi and Parey 2018). The most important fact to consider here is the tradeoff to forgo present earnings and invest into education, which will only later result in better wage-earning capabilities. This especially affects young women that wish to bear a child at some point, as they face a tradeoff between occupational choice and desired fertility. A child would interrupt their career and thus leave them less time to benefit from the investment in education, rendering it less attractive right from the beginning.

2.4 Occupational wage gap

The human capital model alone does not suffice to explain the gender wage gap. It is a common social conception that there are stereotypical male and female jobs, by definition these perceptions are manifested by a majority of 70% of one gender present within a certain occupation (Busch 2013). This sparks two schools of thought, as some scholars promote a “taste” hypothesis, where the employer actively favors men to maximize utility and thus discriminates against hiring women. On the other hand, we have the argument of “occupation crowding”, where female workers are segregated to certain occupations either because of individual preferences or because they are excluded from certain professions because of their characteristics (Solberg and Laughlin 1995). The phenomenon of the occupational wage gap also accounts for a large portion of wage differences between men and women (Ruijter 2003). Even though women have now overtaken men in obtaining degrees in higher education, they have yet to reap the benefits (Riphahn and Schwientek 2015). This might be partly associated with the choice of the college major, and later on, the resulting field of occupation. For example, Puhani and Machin have found that the choice of subject matter for a college degree can explain between 2-4 % of the higher

wages earned by males, after controlling for industry, age and other effects. For the explained gender wage gap, that would amount to around 9-19 % of variation (Machin and Puhani 2003). The following figure by Sloane et al. showcases, how differently men and women still choose their college majors, even though there has been some convergence since the 1950's. In the left panel, one can see that even after 50 years of gender education convergence, there is still a male dominance in business, physical sciences, history, and engineering. On the right panel, it is apparent that there are still more than 5 women for every man in nursing and pharmacy college tracks as well as 4 women for every man in educational studies.



Source: Data from the 2014–2017 ACS and are restricted to those with at least a bachelor's degree. See text and the online Appendix for additional details.
Note: These figures plot the ratio of females to males within major category. The left panel shows trends for a set of majors where men outnumber women. The right panel shows trends for a set of majors where women outnumber men.

Figure 1 Convergence of historically gender dominated college majors (Sloane et al. 2021)

It is highly advisable to understand these labor market dynamics of schooling, as the choice of the college major can be seen as a pre-occupational investment in future earning capabilities. This means that even before they have actively entered the working world, men and women have already predetermined their wage-earning capabilities to a certain extent before occupational choices and potential breaks in the firm tenure due to child-rearing responsibilities take effect (Sloane et al. 2021). There is, however, a trend towards convergence in the college majors, that will diminish the effects of higher education on the gender pay gap in the long time. As mentioned, Sloane et al. show this by comparing

the developments between the gender and choice of major within five-year birth cohorts in the US.

This easily translates to another determinant factor of income that has a strong effect on gender diversion in pay, the choice of the occupational sector. It has been proven that areas related to science, like mathematics, information technology or engineering (STEM) are well paid and, in many cases, male-dominated fields of work. Women tend to work in fields like education, health or psychology, which yield lower incomes (Dey and Hill 2007).

Leuze and Strauß provide two possible explanations as to why female-dominated occupations do pay less. On one hand, they argue that because the tasks that are carried out by women do have a strong orientation towards reproductive and care work, they are considered as less valuable in the labor market. This is because these tasks are simultaneously being carried out by women in the private sphere without any financial reimbursement. Figure 2 shows how male spheres of work focus around computing, IT, as well as developing and construction, while women-dominated areas of occupation focus on education and caring, which are tasks that are also carried out in the domestic sphere predominantly by females.

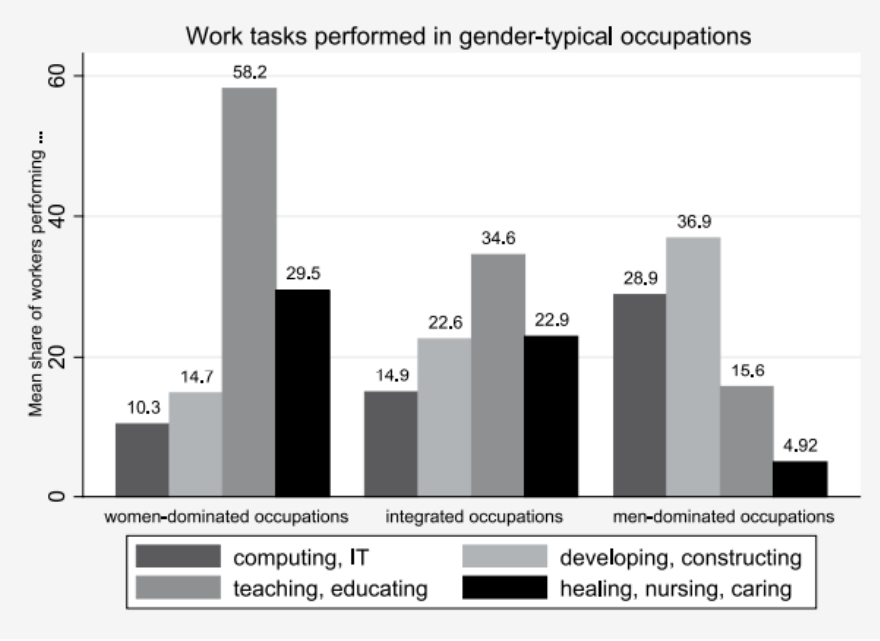


Figure 2 Work tasks performed in gender-typical occupations (Leuze and Strauß 2016)

On the other hand, they provide the argument that areas with high female participation often feature a more family-friendly working schedule such as part-time employment,

which is also seen as a less valuable and less productive employment scheme in the traditional male view of the labor market, as it does not constitute “full employment” (Leuze and Strauß 2016). Especially the part-time working schedule is still a highly unusual form of employment for men, as it is somewhat reserved for mothers. The following Figure 3 illustrates how women-dominated occupations are predominantly part-time or partially from home arrangements that allow for a better balance between domestic and professional work and responsibilities.

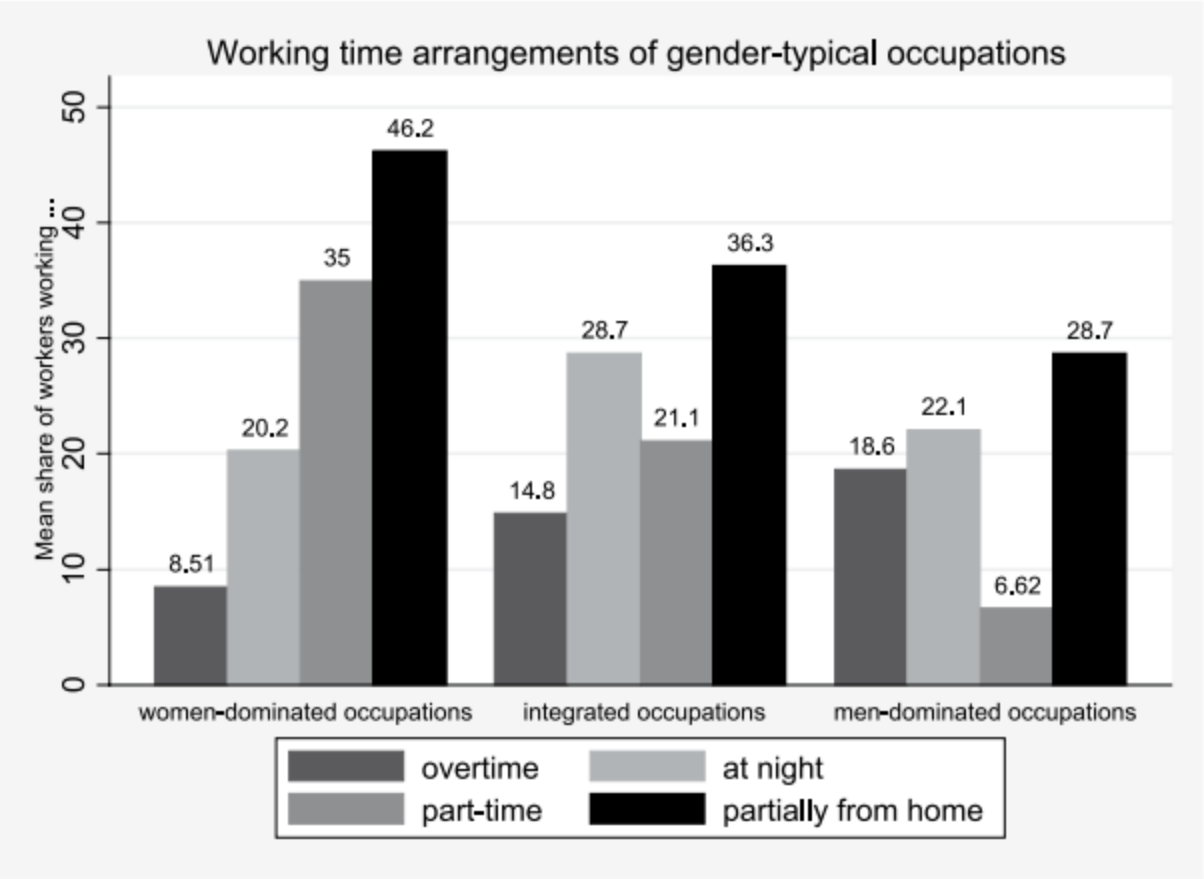
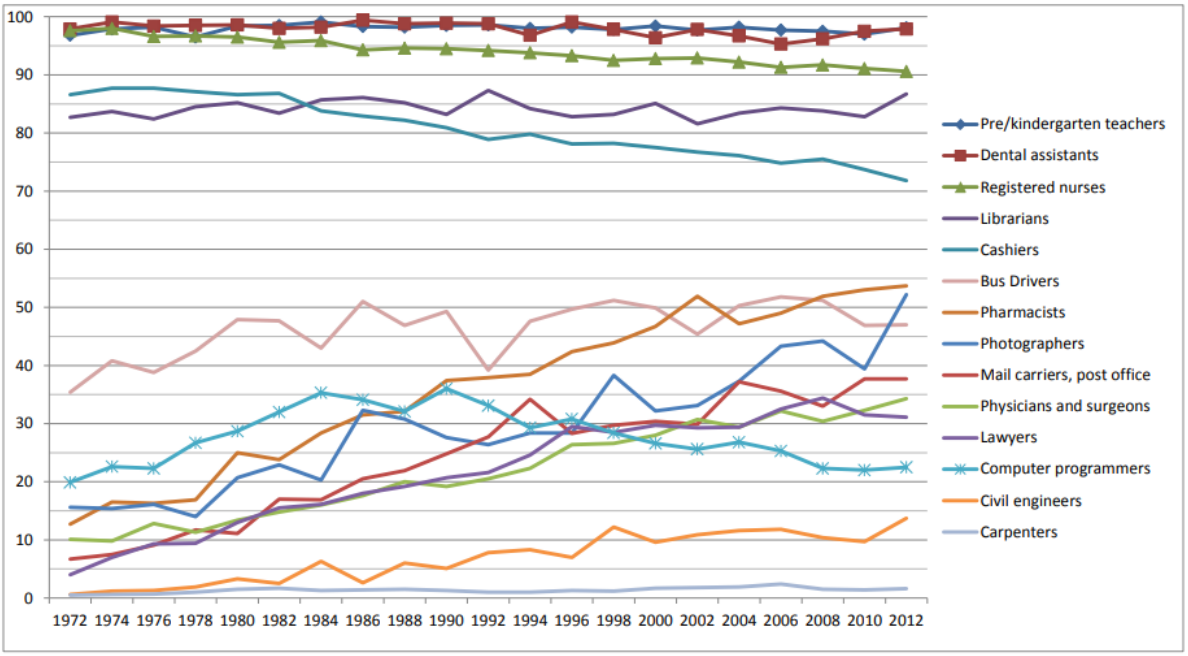


Figure 3 Working time arrangements in gender-typical occupations (Leuze and Strauß 2016)

This does, however, not change the fact that women are overrepresented in public sector jobs including non-manual labor like social services, which are still hugely underpaid in comparison to private sector employment (Hartog and Oosterbeek 1993; Dolado et al. 2001). This intrigues the question, what are the motives that men and women are choosing different occupations and how do they relate to certain gender narratives. Snyder and Green identify three reasons why men avoid female-dominated professions: less opportunity, less prestige and pay as well as social pressure for men to participate in a mascu-

line field of work. It is an immense issue within society, that the so-called HEED professions, meaning healthcare, early education as well as domestic care roles are so undervalued and thus result in a low status as well as a low salary for those employed there. Men orient themselves towards high-earning STEM careers (science, technology, engineering and mathematics), while women have a stronger sense of responsibility towards serving the communal good and thus end up in the professions which are vital to the functioning of our society, but not paid accordingly (Block et al. 2018). The unequal distribution has been illustrated by Hegewisch and Hartman, showing only minuscule evidence of a convergence between the typical male and female areas of occupation (Hegewisch and Hartmann 2014).



Notes: Data refer to annual averages for all persons employed aged 16 years and older.
Source: IWPR compilation based on the U.S. Department of Labor, Bureau of Labor Statistics, "B-20. Employed persons by detailed occupation, sex, and race, 1972-81;" "Employed persons by detailed occupation, sex, and race (1982);" "Employed persons by detailed occupation and sex, 1983-2002 annual averages;" "Table 11. Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity." 2003 onwards. Data are from the Current Population Survey.

Figure 4 Women's Share of selected occupations (Hegewisch and Hartmann 2014)

Within this setting, it is worth mentioning that still there is a tendency for the relatively small percentage of men present in these jobs to rise towards the administrative, better paid levels in female-dominated professions, called the glass escalator effect. Women remain in the bottom-heavy structure of these occupations, where a lower wage is usually prevalent, thus further widening the gender wage gap (Snyder and Green 2008). It will later become clear that this lopsided overrepresentation of women in certain occupations might play a large role in how the Covid-19 pandemic has affected female wages.

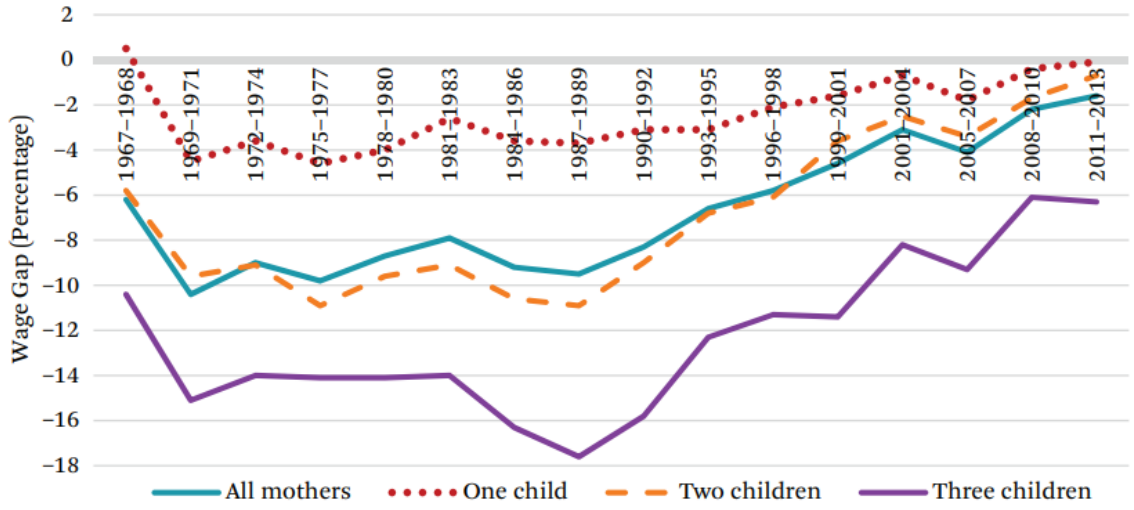
2.5 Division of domestic labor

In addition to the segregation between men and women in the formal workplace, there should be no understating of the effect of the division of labor in the home as well as traditional gender roles in the family life that usually postulate a higher responsibility of women relating to non-market work (Blau and Kahn 2017). Research has surfaced three main mechanisms that are strongly determinant in this area. At first, is it assumed that due to comparative advantages in specialization, rational decision making would lead a household to place the men as the main source of income, while the women take care of household responsibilities. This also feeds into the second theory, that because of their higher income, men have more bargaining power than women and are thus able to negotiate a lower involvement in domestic tasks. Third, we have the traditional gender norms that would suggest that it is a male characteristic to not participate in housework, while it is ascribed as a "natural" behavior for women (Grunow et al. 2012).
It is a mixture of societal conventions, utility maximization as well as underlying gender norms that push women towards assuming a strong role in the household, both subconsciously as well as above the surface. And while it may not be perceived as such, it will also become visible that this predeterminant inequity of domestic responsibility is among the main drivers for the gender wage gap, as well as one of the most influential differentiations in the effects of the Covid-19 pandemic on gender equality. But it's not only the domestic housework, such as cooking and cleaning where the woman has to shoulder a much larger burden than their male counterpart, it is also the presence of children within the household that will engage a woman in non-market work, often unpaid. There is strong evidence that the difference in effort and responsibility relating to care work in the household is a strong obstacle to female wage equality. Taking care of this nonmarket work takes time and effort, strongly reduces flexibility relating to working hours, promotes occupational choices that foster female working patterns and limits the time that can be invested into human capital generation (Becker 1985).

Child-bearing and rearing has traditionally been a female task, due to obvious biological differences in fertility capabilities. A key determinant concerning the topic of wage differentials is the "motherhood wage gap". It is estimated that women take an indirect wage

penalty of up to 15% per child, due to leaving the workforce and thus forgoing work experience, which as discussed, is an investment in human capital that their male counterparts can capitalize on (Anderson et al. 2002). Several hypotheses aim to explain these changes. First, it is assumed that the presence of a child in the household might limit the mother's mobility and thus will incur higher searching costs for a proper job. This then results in a stronger tendency to accept a job that does not present a decent match, but out of their limited situation in terms of opportunity, women are pressured to settle for a sub-par working arrangement. In addition, employers might discriminate against women out of the suspicion that they are less productive because their primary concern is not work-related but has stronger focus on family and child-related matters.

Also, there is strong evidence that working in part-time leads to a depreciation in human capital over time (Felfe 2012). Felfe also adds, that especially mothers that change employers after maternity incur a wage penalty of up to 24,3%, as an ongoing employment might serve as an insurance for working amenities, while entering a new contract under a supposed deficit bargaining position will likely result in worse working conditions. The motherhood wage gap of course is not only detrimental to women's earning capabilities in comparison to men, but of course also effects intra-gender differences in income for women. While there has been a strong improvement over the years, the number of children also highly affects the wage penalty between mothers and non-mothers, as women with three or more children are the most disadvantaged (Pal and Waldfogel 2016). This assumption will also be reevaluated later when the discussion will highlight how the number of hours of childcare that have been added due to the closure of childcare facilities affected female working arrangements.



Source: Authors' calculations based on CPS data (sourced from King et al. 2010).

Figure 5 Family wage gap by number of children (Pal and Waldfogel 2016)

This also attains to a higher engagement of women in child-rearing, where married men do rarely suffer a wage penalty, while married women do experience a significant decrease in hours worked and the wage paid and thus endure a rather distinctive correlation between the presence of a child in the household and their labor supply (Lundberg and Rose 2000). Married and unmarried women alike also suffer an immense wage penalty due to the unequal division of household work that is not directly related to reproduction. Time-consuming tasks such as cooking and cleaning, which have to be performed daily, can constitute as much as 14% of the explained wage gap when controlled for in empirical studies (Hersch and Stratton 2002). There is evidence that suggests that if a woman is able to improve her economic situation and becomes less dependent on her spouse's income, this will strongly promote a more egalitarian division of household labor. This is partly due to the fact that by putting in more market hours, thereby earning more money, the household is able to afford services that substitute core household duties such as visiting a restaurant or hiring a childminder (Kuhhirt 2012).

Research points out that the birth of a child leads to a strongly gendered division of household labor, where the man will exploit his comparative advantage in paid work while the women resort to their traditional role as a housekeeper. It is also quite notable that the recent decline in terms of inequality in time spent on housework is not due to men increasing their involvement to a fair share, but rather the steep decline of female participation in household tasks and subsequent substitution by external service providers like

housekeepers. In addition, the division of intrahousehold work is influenced by the economic situation of the participants, where with rising wages of the male participant, the time spent on formal work for women decreases and is reallocated to domestic work, as if female income were more dispensable (Gwozdz and Sousa-Poza 2010). These factors will strongly influence how households allocate responsibilities during the governmental lockdown measures introduced during the pandemic and are thus feasible for further consideration.

2.6 Explained vs. unexplained wage gap / discrimination

In March 2020, the explained gender wage gap in Germany was at 21% which is due to women working in sectors and jobs that are low-paid in comparison to male dominated jobs as well as their low presence in high-earning positions within companies (Schrenker and Zucco 2020). This measure, however, is to be seen as a rather raw instrument for estimating the gender wage gap, as it does not control for individual qualifications, working schedules, sector, or size of the company (Busch and Holst 2013). Controlling for differences in human capital characteristics as well as occupational sectors and other explanatory variables in gender wage theory and research is quite crucial, as it helps distinguish between the raw gender wage gap and the unexplained, discriminatory part of the gender wage gap.

The raw wage gap assumes that male and female workers have similar education as well as working hours and are generally comparable in productivity predictors. This generalization in turn leads to an overstatement of the gender wage gap because it does not control for individual differences. When these characteristics are controlled for, one can derive the unexplained gender wage gap that shows the actual discrimination in the labor market for the price of female work (Oostendorp 2009). In 2020, this unexplained gender wage gap in Germany was assumed to be at 6%, which can be taken as the wage penalty that equally qualified and employed women endure in comparison to men. A prevalent assessment of the unexplained gender wage gap is the Blinder-Oaxaca decomposition method (Oaxaca 1973). While its result is often dubbed as the ”discriminatory” part of the gender wage gap, it is actually more of a summary variable for all unobserved characteristics (Jann 2008). It is applied by comparing two groups, in this case men and women, an outcome variable, in this case the log of wages, and different predictors such as education or

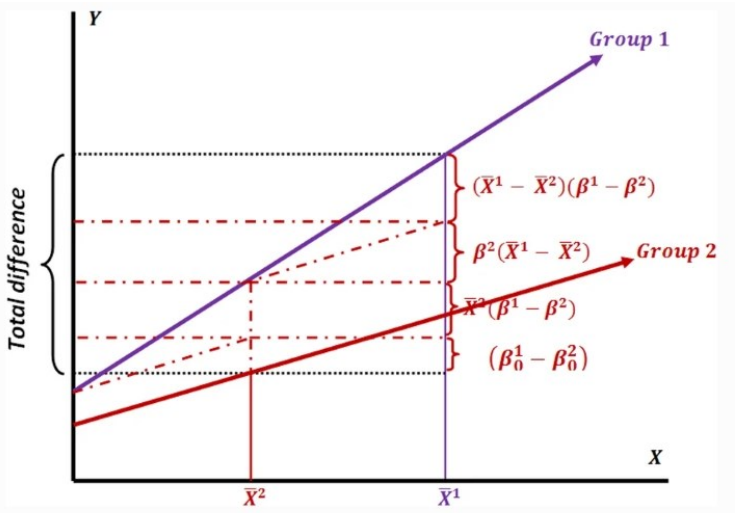
occupational sector. The log of wages is used as wages tend to be very skewed because of outliers on the spectrum like high-earners. Also using the log of wages, the differences between groups can be interpreted as percentages. We observe an outcome difference (R) that is derived by subtracting the expected mean outcome of Group B $\mathrm{E}(Y_B)$ from Group A $\mathrm{E}(Y_A)$.

$$R = \{\mathrm{E}(Y_A) - \mathrm{E}(Y_B)\}$$

One can now analyze the contribution of group differences (gender) in predictors such as education or occupation sector on the outcome difference (R) in wages.

$$R = \{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'ß_B + \mathrm{E}(X_B)'(ß_A - ß_B) + \{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'(ß_A - ß_B)$$

Here, the first term $\{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'ß_B$ is describing the different levels of endowment of predictor variables between groups, which measures the expected change in outcome (wage) if Group A had the same predictor levels as Group B. The second term $\mathrm{E}(X_B)'(ß_A - ß_B)$ measures the contribution of differences in the coefficients, by weighing them against Group B´s predictor levels. The third component $\{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'(ß_A - ß_B)$ is an interaction measure for differences that exist simultaneously between the two groups. This decomposition is formulated from the viewpoint of Group B, but could also be accommodated for Group A.



Decomposition of the group difference in mean predicted outcome (the interaction model) by selecting Group 1 as the reference (from the perspective of Group 2)

Figure 6 Decomposition of group differences in mean predicted outcome (Rahimi and Hashemi Nazari 2021)

There is, however, a more common approach to determining the discriminatory contribution between two groups by deriving a twofold decomposition, which introduces a non-discriminatory coefficient vector ß* into the equation as such:

$$R = \{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'ß^* + \mathrm{E}(X_B)'(ß_A - ß^*) + \{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'(ß^* - ß_B)$$

This then creates two terms, the first $\{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'ß^* + \mathrm{E}(X_B)'(ß_A - ß^*)$ being the explained outcome gap that can be attributed to differences in the endowment of predictors, which is also called quantity effect, and the second term $\{\mathrm{E}(X_A) - \mathrm{E}(X_B)\}'(ß^* - ß_B)$ which stipulates the differences that are accounted for by unobserved effects. This term is usually referred to as discrimination, even though this is not a correct assessment. The second term incorporated every unobserved predictor, which means that every structural predictor that has not been incorporated within the first term might distort the actual prevalence of the discriminatory effect (Jann 2008). It is important to understand this model, as it serves as the basis for empirically determining a discriminatory tendency between two groups, which is the approach this work will take to describe the gender wage gap development between men and women caused by the Covid-19 pandemic.

Moving on, there is research available that provides evidence that personality traits and behavior can have a strong effect on labor market outcomes, especially on salaries. A

popular model is the Big Five Personality trait model, which consists of emotional stability, openness to experience, agreeableness, extraversion as well as conscientiousness and the according compliance with the person they are describing can be seen as the rough outlines that define the personality of an individual (Cobb-Clark and Schurer 2012). While these approaches are surely relevant, they will not find their way into the empirical part of this work, as these traits are more of an individual measure than a macroeconomic predictor that captures the changes induced by the Covid-19 pandemic.

3. Covid-19 and the gender wage gap

In the following section, the author will now provide and discuss recent literature as well as research that has surveyed secondary effects of the Covid-19 pandemic. Apart from medicinal acclaim, the social sciences have had a strong interest in the manifold repercussions of the measures that were introduced to reduce the spreading of the virus, such as lockdowns and social distancing measures. As of now, the scientific evidence is somewhat inconclusive as to how exactly the Covid-19 pandemic and the gender wage gap interact. While there are many pointers that hint at a strong disadvantageous situation for women in the short run, the transformation of the labor market towards more flexible working arrangements might help diminish the gender pay gap in the long run (LaSalle 2021).

3.1 Context

The World Health Organization, WHO, has declared the Covid-19 outbreak and global spread as a pandemic situation on the 12th of March, 2020. Since then, the world has witnessed a huge number of deaths associated to the virus, economic turmoil as well as increased poverty and inequality (Ciotti et al. 2020). While it is of common knowledge what the Covid-19 pandemic has meant for the global community, it is deemed adequate to draw a short summary about what has transpired, how Germany was affected and what the individual consequences were for the average citizens. From December 2019 onward, there was a continuous spread of a henceforth unknow type of pneumonia, which originated in the Chinese province of Wuhan. Authorities of the WHO identified this development as a possible threat to public health and an epidemiological danger by the end of the month, around the 31st of December 2019. As there had been cases of SARS-CoV related

respiratory sickness in Asia before, Chinese authorities quickly tried to isolate the new virus, determining that it was indeed a novel version of the SARS-CoV that had originated in China in 2002 (Hui et al. 2020). Any attempts of containment were in vain and the virus quickly spread towards Europe, where after Italy, Germany was among the front row of countries affected with the first registered case at the end of January, which quickly sparked a rising number of infections in the whole federal republic (Roehr et al. 2020).

On March 22nd 2020, the population was subjected to the first social distancing measures, also called "lockdowns" which were mandated by the German government. These included the closure of schools and early childcare institutions, mandatory home office arrangements as well as contact restrictions, and have since significantly altered the everyday life of each and every citizen (Koenig et al. 2021). While these measures had a positive effect on slowing down the spread of the pandemic and thus preventing new cases of Covid-19, they took a high toll on workers and businesses (Gupta et al. 2020). Many stakeholders in economic, social, or academic fields argue that due to the pandemic being one of the defining events in recent history, there will be no return towards what was considered as "normal" before crisis struck (Bonacini et al. 2020).

Also, many long-term consequences that have shifted social norms below the surface of general awareness are yet to be fully unearthed (Akat & Karataş 2020). Aggregate data has shown that the Covid-19 pandemic has caused the biggest economic shock since the great depression and instead of destroying primarily the financial sector like the crisis of 2008, it has shaken the labor market to its core (Campello et al. 2020). In Germany, women are supposedly more likely to earn less, have more precarious job situations, being less protected by social security measures, and have a higher workload in the household. All these factors could contribute to them having less capacity to endure an economic crisis, which will be discussed within the following deliberations (Burki 2020).

3.2 Unemployment

While other countries like the US (20%) and the UK (17%) have suffered worse because of their liberal labor market, there still were around 5% of the employees surveyed in Germany who had lost their jobs by the beginning of April 2020, especially women as well as workers without a college education (Adams-Prassl et al. 2020). In comparison to the US, this shock is rather mild, as more neoliberal labor market arrangements foster a

culture of fast layoffs and low worker protection, while the German model has a stronger social safety net. An example of this are the very flexible short-term working arrangements (STW) which are present in Germany and protect workers from being laid off by reducing their hours and having the state pay part of the wages.

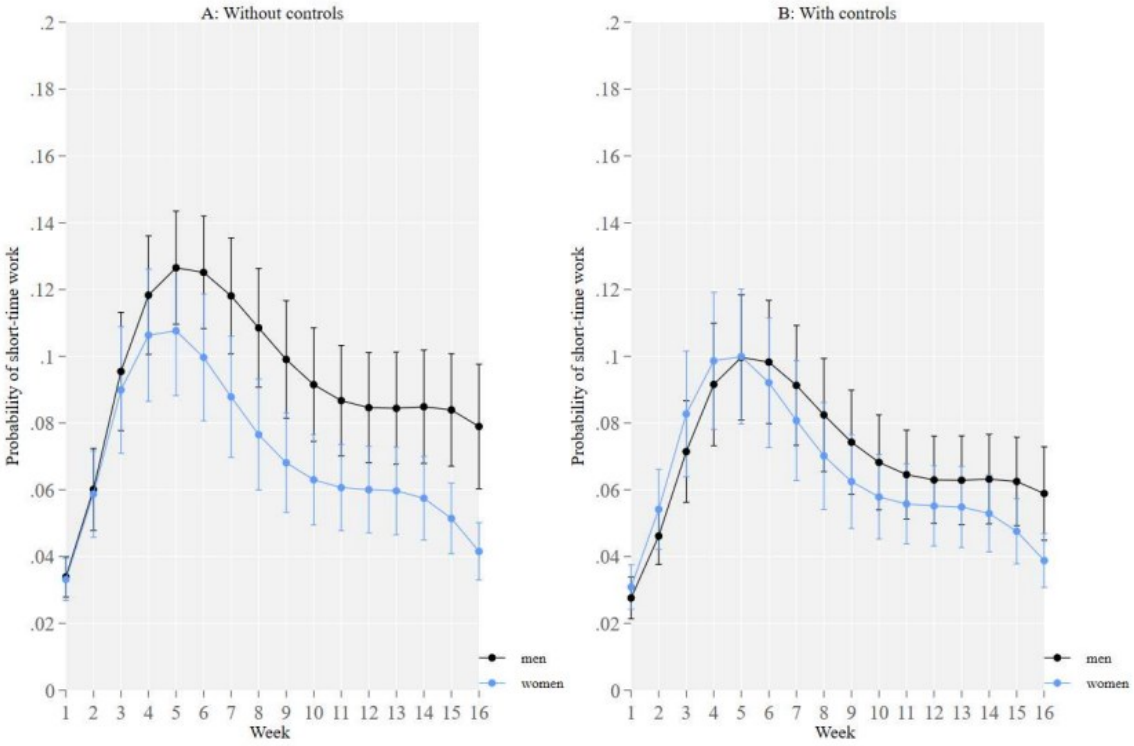


Figure 7 Probability of short time work between March and July 2020, controlled for sector (Moehring et al. 2021)

There is, however, a caveat in this quite generous social protection measure, as it is indirectly highly gendered and is affected by the strong dualization within the German labor market. This is due to women being more present in the low-income sector as well as overrepresented in the service sector. Both categories are less likely to be covered by STW and often lay off employees instead, resulting in more unemployment for women (Moehring et al. 2021). Again, women are disadvantaged in their ability to profit in an egalitarian way from social benefits and hence are likely to take a much harsher hit in their earnings and employment situation then most men might during the first weeks of lockdowns in Germany. The illustration from Moerhing et al. highlights how men have been much more likely to enter short-time work arrangements during the first wave of the pandemic.

In many cases when a firm faces downsizing, women and minorities are the first ones to be let go (Kalev 2014). This is due to structural practices that involve e.g. firm tenure as a selection tool for layoffs, which disadvantages women because of the motherhood gap and the associated absence from the workplace. As in the case of Covid-19 pandemic related layoffs, it is likely that women might also be among the first employees to be let go (Kalev 2014). Being unemployed for a longer duration of time does have a strong negative effect on the ability to reintegrate back into the labor market and often comes with a strong wage penalty in the aftermath, especially for women (Reichelt et al. 2021). Touching upon the same subject, it was stated earlier that working experience is a determining factor for career advancement as well as earning prospects, and the unparalleled loss of employment as well as working hours during the social distancing measures could have a pronounced effect on female earners for a long-time span. There is however the assumption that as the Covid-19 pandemic has not been an economically induced crisis, the loss of employment is of a temporary nature and will likely return to pre-crisis levels in the medium run. Especially the German system of Short-term work was able to buffer initial labor market effects (Adams-Prassl et al. 2020).

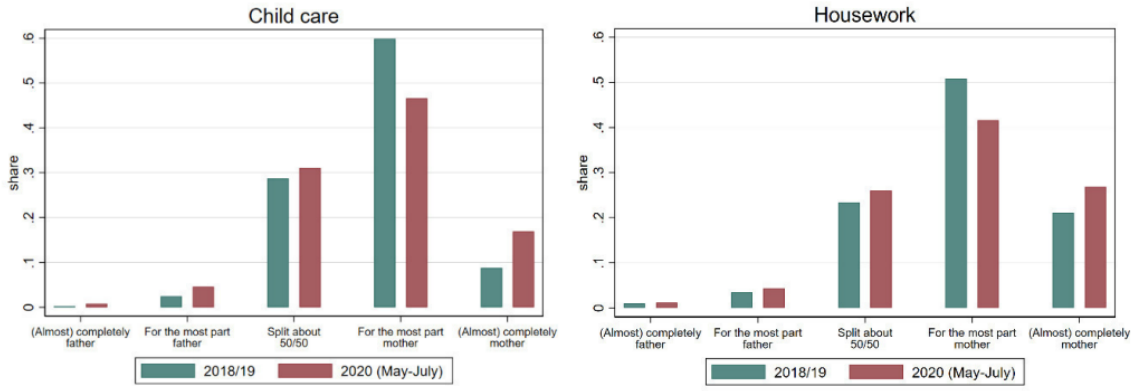
3.3 Child-care responsibilities and lockdowns

While females might have been disadvantaged in the sector of paid work, the domestic situation presents another potential threat to equal pay opportunity. Interestingly, a study on the Australian employment situation during the first wave of Covid-19 has found contradictory evidence regarding this area. In this case, all economic pointers such as industry and working arrangement had indicated that men should have been more strongly affected by layoffs, as they were in recent recessions, but the data showed that it was indeed women that have suffered from more unemployment by at least two percentage points. This bears the conclusion that the composition of different household and childcare responsibilities within a family could does indirectly affect earning potential (Richardson and Richard 2020).

The Covid-19 pandemic has created a huge demand-side shock in terms of childcare, as due to the closure of schools and kindergardens, the number of hours that had to be covered within private arrangements exploded. These hours were mostly covered by women, which towered men in around 10 weekly hours that they spent more on childcare on aver-

age. This is not surprising, as women already take the leading role in caring for children, regardless of their employment status. Still, it was even more amplified to the higher number of women that became unemployed compared to men and redirected their time towards domestic tasks (Sevilla and Smith 2020). In many cases, the time spent in paid working arrangements has declined, while the time spent taking care of children and domestic tasks has significantly increased. In a provisional study that was done in the first week of the lockdown in March, in around 50% of all surveyed households with children, the mother was the sole care-taker, while men were the sole bearer of child-rearing responsibilities in only 25% (Moehring et al. 2020). In addition, according to one study, the number of hours that women spent on taking care of their children increased by 2.9 hours, while for men it increased only around 2.5 hours. This trend of a stronger female engagement is visible among all social, economic and ethnical groups in the SOEP-CoV Study (Zinn et al. 2020).

This is unsurprising, as it has been researched that couples traditionally try to optimize their economic outcome by maximizing their earning capabilities. This means that the partner that has the lower wage, which in most cases is female, reduces his or her working time in order to free up resources for taking care of children. The Covid-19 pandemic has likely only amplified this preexisting scenario even further (Kohlrausch and Zucco 2020). This is also supported by another study, that compares the levels of household and child-care responsibilities pre and during Covid-19 lockdowns in Germany, showing that while there was not really a huge reshuffling of care responsibilities, households where the women was the main domestic worker entrenched and deepened the already unequal division in an episode of “retraditionalisation” (Jessen et al. 2021). Figure 8 illustrates this shift towards more gendered division of labor in the household between the years before and during Covid-19.



Source: pairfam, wave 2018/19 and pairfam COVID-19 supplementary survey 2020.

Figure 8 Division of child care and housework among couples with at least one child aged up to 14 years (Jessen et al. 2021)

Taking into account the research presented in the section about division of labor in the household, we know that this arrangement might especially hurt women and their wage earning capabilities (Czymara et al. 2021). Some scholars even go as far as having nicknamed the Covid-19 pandemic a "patriarchal pandemic" or a "shecession" as many of the developments have shown signs of a reversal of egalitarian achievements and resurging traditional gender roles (Allmendinger 2020). These terms do however relate to the shorter effects and it remains to be seen, in which direction the gender wage gap will develop due to the Covid-19 pandemic in the long-term.

In regular recessions, male employment is severely more affected than female, but the implications of Covid-19 are lopsided. Men usually work in procyclical occupations, such as construction or manufacturing, while women tend to work in more stable jobs that are not as exposed to changes in the general economic dynamic of the market, like healthcare and education. These are usually less volatile to economic shocks, making female income less subject to crisis. For Covid-19, this assumption might need to be altered (Coskun, Sena, and Husnu Dalgic 2020). It has had a severe effect on sectors with female employment, care needs at home have increased due to e.g. school and kindergarten closures and the lost work experience will have a long-lasting effect on wage expectations for women (Alon et al. 2020).

3.4 Occupational differences

In this recession, jobs that have usually been spared from crisis and layoffs, such as gastronomy, tourism, accommodation and hospitality have been among the hardest hit sectors, These are all fields of work which are traditionally female dominated, not only in Germany but around the world (Carli 2020). As mentioned before, women are strongly overrepresented in HEED professions, which include healthcare, early education, and domestic roles. Many of these jobs are minimum wage, temporary or informal professions that have been hit hardest by the Covid-19 pandemic (Thomason and Macias-Alonso 2020). Female job losses and the following unemployment are associated with a deviation of the division of a couples housework towards more traditional gender roles, where women take up even more female specific tasks around the household after losing their income (Voßemer and Heyne 2019). The following illustration shows how present females are in so-called front-line occupations, meaning that their jobs might have faced immense layoffs or were harshly exposed to dire working conditions due to Covid-19 (Tucker 2021). There is research that suggest however that the prevalence of women in essential jobs actually outweighs the layoffs faced due to crisis-struck occupations, benefiting female labor force participation in the long-run (Doorley et al. 2021).

THE WAGE GAP FOR WOMEN IN SELECTED FRONT-LINE OCCUPATIONS

	Share of occupation that is women	Share of women in occupation who are women of color	Median hourly earnings for women in occupation	Median hourly earnings for men in occupation	What women make for every dollar men make
Dental assistants	94%	41%	$ 16.25	$ 19.23	$ 0.85
Registered nurses	88%	30%	$ 32.69	$ 35.10	$ 0.93
Home health aides, personal care aides, and nursing assistants	87%	60%	$ 12.98	$ 14.42	$ 0.90
Hairdressers, hairstylists, cosmetologists, and barbers	83%	35%	$ 13.80	$ 14.42	$ 0.96
Pre-K, K-12, and special education teachers	79%	26%	$ 24.04	$ 27.40	$ 0.88
Waiters and waitresses	69%	39%	$ 10.96	$ 14.09	$ 0.78
Cashiers and retail salespeople in grocery stores	68%	46%	$ 11.54	$ 13.46	$ 0.86
Food preparation workers	58%	50%	$ 10.58	$ 11.68	$ 0.91
Maids and housekeeping cleaners, janitors and building cleaners	55%	66%	$ 11.54	$ 14.66	$ 0.79

Source: NWLC calculations based on 2019 American Community Survey using IPUMS. Median hourly wages are for full-time, year-round workers. Hourly wages are derived by dividing median annual earnings by 2,080 hours, which assumes a 40-hour work week for 52 weeks.

Figure 9 The wage gap for women in selected front-line occupations (Tucker 2021)

3.5 Working from home (WFH)

Due to governmental containment measures, people also had to work from home. Many companies had to adapt far reaching working from home arrangements in order to not only continue with their operative business, but also to keep their employees working. While working from home has been seen as a great way to improve the work life balance, especially for parents with kids in the household, there is still an open discussion whether the spread of WFH arrangements during the Covid-19 lockdowns benefited gender equality (Arntz et al. 2020). It is argued that while it allows for a better stipulation of domestic duties and paid work, it may also reduce the productivity of workers. In a normal setting, women report the same productivity and job satisfaction as men, which should also translate when working from home. This might not hold true, however, during the lockdown situation. More people at home due to social distancing rules results in more domestic work with no help by external services such as childcare facilities or cleaning services. Although it was easier for women before the pandemic to differentiate between work and home life, the boundaries have now become blurry and are thus creating interferences between both worlds (Feng and Savani 2020). While seen as a feasible way to maintain employment during the pandemic, there is also research implicating higher income inequality and favorable outcomes for white, high-paid males by WFH arrangements (Bonacini et al. 2020). Even when both parents had jobs that allowed them to perform their professional duties from home, the reduction of hours for women was 4.5 times larger than for the corresponding male partners (Collins et al. 2020). In addition, the percentage of women that felt a high strain by working in home office and taking care of the children in the household increased by 27% during the Covid-19 lockdowns (Frodermann et al. 2020).

So, while some have labeled the pandemic as the great “equalizer” as it limits the economic activity of everyone, this assumption might not hold. Women are still prevalent in in-person service jobs like restaurants, tourism or care professions which are sectors that are under the most duress during governmentally induced economic lockdowns (Qian and Fuller 2020). Apart from salaried employees, it is also necessary to take into account that a large number of women are self-employed in the service industry, which due to its necessity of physical contact has also been hit hard by the governmental measures intro-

duced in March. According to research, self-employed women in Germany were up to 30% more likely to report significant income losses related to the Covid-19 pandemic than their male counterparts (Graeber et al. 2021). In addition, due to the social distancing measures introduced, women are no longer able to benefit from outsourcing domestic work towards a household help. This had so far especially benefited women with a high wage, that were able to afford such an investment and could thus focus on their career, resulting in receiving better pay in the long run (Craig et al. 2016). It is a possibility, that these developments will have grave consequences for the gender-pay gap. The accumulation of factors and implications of Covid-19 that directly or indirectly affect female income prospects appears to be manifold, disproportional, and interdependent.

3.6 Contradicting evidence

While the presented research appears to be drawing a rather dim outlook for female earnings which is justified by the observed short-term effects of the Covid-19 pandemic, a different school of thought has entered the scientific stage. Various papers indicate that there is evidence that the flexibilization of traditional working models and labor market characteristics could benefit gender pay equality in a great way. Remote working will prevail even after Covid-19, which could greatly diminish the experience penalty that women usually take due to their domestic responsibilities, as they are able to better combine working from home and housework. In addition, men will be able to take greater responsibilities in the domestic sphere, as their jobs might not require them to be present in the office for 40 hours a week. This will allow women to invest more time into work as well, increasing their wages (LaSalle 2021). Research has long suggested, that an external shock such as a technological advancement, like remote work, or institutional changes, such as forcing everyone exempt from their gender to spend time in their home, could go a long way towards gender pay equality. The obligatory merger of workplace and domestic sphere constituted an immense change in especially traditional male working patterns, as they were more or less forcefully exposed to an increased burden in domestic tasks (Craig and Churchill 2020). This might be viewed as a unique window of opportunity, as the newly won appreciation for unpaid work in the household by males might have increased while at the same time women can benefit from working from home arrange-

ments, facilitating the balance between paid work and unpaid work for females. These two developments might help to dimish the long-established threshold of separation of home and work that has held women back from earning the same as their male counterparts due to forgone work experience (İlkkaracan and Memiş 2021).

3.7 Synthesis

Condensing the theoretical groundwork that has been laid out, it is advisable to address the development of the gender wage gap under the Covid-19 pandemic in a bipartisan fashion. While it is almost beyond doubt that the gender wage gap will have changed due to the aggregate shock that the labor market endured, there is ample evidence supporting both an enlargement as well as a narrowing of the difference in pay between genders. The advantage of combining theoretical research with quantitative data analysis is that while the scientific basis does aid in formulating areas of interest as well as hypothesis, the data provides a neutral assessment of the situation. Over the course of writing this paper, the canon of the works that address this topic did also change, as the expected or predicted development of the gender wage gap was estimated to be strongly negative in the onset of the pandemic, while papers that have assessed the situation with a longer duration of collected data do argue for a more positive development. Therefore, the decision was made that this paper does not formulate a directed hypothesis for either side of argumentation but will operationalize the factors and causes addressed by the contradicting evidence. This will aid to synthesize a regression model and successively a result that is not tainted by a premeditated school of thought but evokes a neutral assessment of the situation based by the data collected in the sample. Leading up to the final research question and hypothesis, it is therefore advisable to investigate the data at hand before condensing the summary statistics into a regression model.

4. Data and summary statistics

4.1 Methodical approach

The methodical approach for the empirical work is oriented on other works based on the SOEP-CoV study, especially research that has a focus on economic outcomes as well as

investigations that have a focus on gender disparities (Schröder et al. 2020; Graeber et al. 2021). These papers, among others, have already done a great deal towards establishing a foundation of how data from the SOEP-CoV study can be operationalized to investigate how Covid-19 has affected different groups in a strongly heterogenous way. Especially the work of Graebner et al. proves of much worth, as the focus on the effects of Covid-19 on the female self-employed also investigates changes for the general self-employed labor force, as well as controlling for gender differences. For this work, the author needs to evaluate ample data in relation to changes in income, education, occupational choice, sector of employment as well as working-time model and the labor market, which is assessed in the part B2 of the SOEP-CoV questionnaire. In addition, the situation of the household in terms of changes in income, child-care expectations as well as division of informal labor at home can be considered as determinant factors in evaluating how the Covid-19 pandemic has had a disproportionate effect on underlying factors relating to female income and accentuated the gender pay gap even more (Kühne et al. 2020).

Exploring the data, it should be possible to determine trends and developments between influential factors, which are commonly associated with the gender inequality gap and effects of the Covid-19 pandemic. A common methodical approach that is used to undertake such empirical work is the Oaxaca-Blinder-Framework (OAB), which has also been used in a study by Busch and Holst on SOEP data to assess how regional factors influence the gender pay gap (Busch and Holst 2008). Using the OAB, the difference in pay can be decomposed into explained and unexplained components e.g. personal characteristics or labor market discrimination, even though Elder et al. argue differently. A pooled regression using an indicator variable for group membership and then evaluating the coefficient on that indicator as the unexplained, discriminatory component proves a valued alternative (Elder et al. 2010). By creating models where the constructing factors of changes in income and their factor loading are controlled for their gender specific effect, it is expected to show the developments for the explained and unexplained gender wage gap. This could support the hypothesis that women may have suffered from larger income losses in comparison due to Covid-19 related effects on gender specific income determinants. The analysis will be conducted using both the statistical software of R for data cleaning as well as SPSS for creating the regression model.

4.2 Household panel studies

The data for this work will be drawn from two different studies, namely the German Socio-oeconomic Panel Study (SOEP) and the additional SOEP-CoV study. These two works are part of one of the longest running longitudinal studies in Germany. In order to understand the broader issues that move our society and economy and thus each and every individual, one has to take a longitudinal approach in collecting data. This means the agglomeration of individual and household data that is enriched with as many parametrical variables as possible over an elongated stretch of time. The SOEP, which is short for German Socio-Economic Panel, fits into this class of studies and is among the richest sources of demographic data available for research in Germany (Goebel et al. 2019).

It was founded in 1984 by the German Institute for Economic Research (DIW Berlin) to create a unique source of research of the German population that would allow scholars from all over the world to assess the effectiveness, relationships and mechanisms of socio-oeconomic shifts and personal well-being over the course of a lifespan. Since its institution, the SOEP has surveyed over 30,000 persons and thus 15,000 households on a yearly basis. Usually done in relation to current theoretical questions of science, especially in the areas of social sciences, economics as well as behavioral studies, it has contributed to over 5000 publications based on SOEP-data (Wagner et al. 2008). A large part of these publications is related to research concerning the distribution of income, as the repetitive nature of the survey allows to follow personal vitas and wage history and thus does not solely provide a momentary snapshot of the current situation but opts for a deeper understanding of the factors that drive income and wages. A similar approach will also be the core research of this work. The following figure will provide an overview about the recurring variables which are ascertained on an iterative basis. The author will give a short discussion about which of these predictors relate to the research question of this paper in the data descriptive that follows in the next section.

Area of research	Details of operationalization
Household composition	Gender, age structure, births, deaths, immigration and emigration, marital status and structure, position as head of household, nationality, migration background
Socio-economic outline	Employment status and professional position as well as structuring according to prestige scales
Labor market and employment conditions	Employment participation and professional position, labour force participation and occupational status, unemployment, occupational mobility, amount and location of working time, characteristics of the establishment and quality of employment conditions, occupational qualification
Educational characteristics	Highest formal school and vocational qualification acquired, current participation in education and degree, further education and education of parents.
Types and amounts of income, household transfers, social security	Around 15 different types of income - each determined at the time of the survey - as well as information on the number of months in the last calendar year, assets (only rudimentary in current surveys as well as in detail in the years 1988, 2002, 2007 and 2012)
Income use, expenditure, consumption	In the SOEP reduced to housing costs, savings and household equipment with durable consumer goods; in 2010 focus on consumption expenditure
Household time and activity budgets and performance	Using rough average time use indicators (in hours/day) and rough lifestyle activities
Housing	Housing status and quality, Housing costs, spatial mobility, Housing environment and household amenities
Health	Scarce self-reported indicators of health status, need for care, disability, since 2006 biennial measurement of grip strength
Transport	Only rough indicators of the transport behaviour and commuting of workers
Participation and networks	Only rough indicators of social and political participation. Family and friend networks are surveyed at intervals of several years surveyed
Personality, satisfaction and worries	Subjective well-being (general and domain-specific), worries, control orientation, time preference, Big Five, risk aversion, reciprocity

Figure 10 Standard survey program of the SOEP (Schupp 2012)

Quantitative research on the gender wage gap is far from trivial. As was established in the theoretical section of this work, the explanatory factors must be assessed in a very minuscule detail, otherwise there is a danger of misinterpretation. This encompasses especially the incorporation of the characteristics that constitute the explained part of the gender wage gap. A failure to include strongly determinant variables could lead to a larger expression of the unexplained part and this would further the conclusion that one is witnessing a stronger discrimination of women because of their gender than is the case (Kunze 2005) . It is necessary to employ a mixture of determining variables as well as control variables to distinguish between random influences on the dependent variable, which is income and on the other hand the factors which are of interest to this work, hence being Covid-19 related datapoints. From the first section of figure 10, one would derive that gender, age, marital status as well as a migration background will likely have an impact on income and therefore need to be included in the model as control variables. Controlling for gender is unnegotiable as this will allow to determine differences in income related to

sex. In addition, employment status as well as labor force participation have an immense impact on an individual's wage-earning capability. As stated in the recap of gender wage gap research in the theoretic section of this paper, there is a sheer infinite number of variables that affect income. It is advisable to establish a certain hierarchy or categorization of variables that groups them in a logical fashion associated with their explanatory fashion, which will be stated in the following paragraphs.

4.3 Data descriptive

4.3.1 Hourly gross wages

The most important variable in this work will be income in the form of wages, as this is the essential determinant of the gender wage gap research. In works in relation to the SEOP-data, this variable is commonly derived by dividing the gross income of the last month by 4 and then dividing it by the actual hours worked each week, which can both be found in the PGEN generated dataset (Goebel et al. 2019; Otten 2020; Schröder et al. 2020). To ensure that the sample provided is not tainted by outliers, there are certain measures that have to be taken. In accordance with other SOEP research, hourly gross wages below 4€ per hour have been removed, as they can be considered as out of regular employment, or an error term created by the mutated variable. The same has been done for wages exceeding 70€ per hour (Selezneva and van Kerm 2016). This will provide the author with the gross hourly wage of the sample size and allows to compare income between groups as well as estimations of how predictor variables affect this variable. As is common practice, the wages will be converted into log of wages for the regression. For the remainder of this work, when referring to the dependent variable in this work, the log gross hourly wage is the object in question. To determine the gender effects, the sex item has been transformed into a dummy variable, where 1 equals male and 0 is female, in order to later show how female wages compare to male income. When plotting the distribution of wages and controlling by gender groups (1=male, 2=female), we can see that the mean male hourly wage at 21.82€ per hours exceeds a mean of 18.11€ per hour for women, so we have a raw or unexplained gender wage gap of 17% for this sample in the year of 2019.

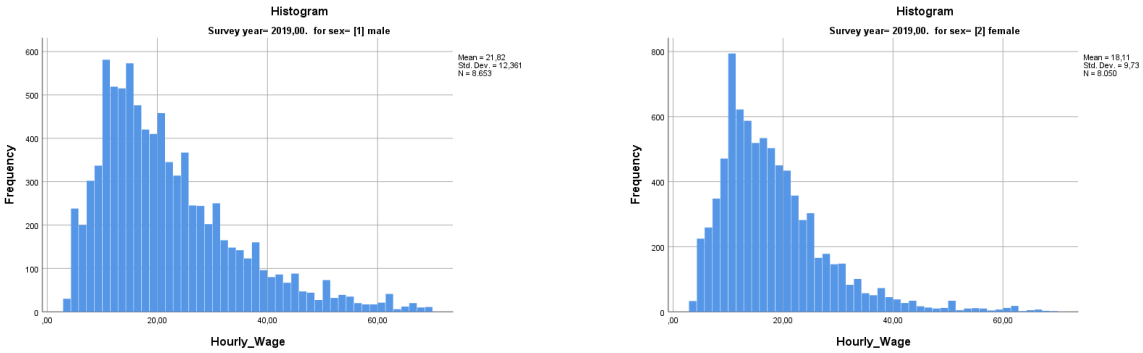


Figure 11 Gendered wage differentials 2019 (own illustration)

For 2020, the raw gender wage gap diminishes, as the sample shows that the means of the male and female population haven grown closer to one another, with 21.51€ for males and 18.54€ for females, which would equal an unexplained gender wage gap of 13,80%. This is a rather positive development, as the gap has apparently closed. It is important to keep in mind that this sample does however not represent the whole of the German population but merely a snapshot of society. In comparison to the numbers of the federal statistical office, while the female wage is almost equal with 18.62€, the males in our sample earn almost 1.36€ less than what the numbers show for the whole republic. So while the results might be slightly distorted in this sample, they are in line with the general trends, which are that the gender wage gap is diminishing year by year and that female gross earnings have seen a serious upswing in 2020, likely due to short-time work arrangements. It can be assumed that high-paid males suffer a gross wage penalty by STW, while low-income sector females benefit from this development, hence closing the gender wage gap (Statistisches Bundesamt 2021).

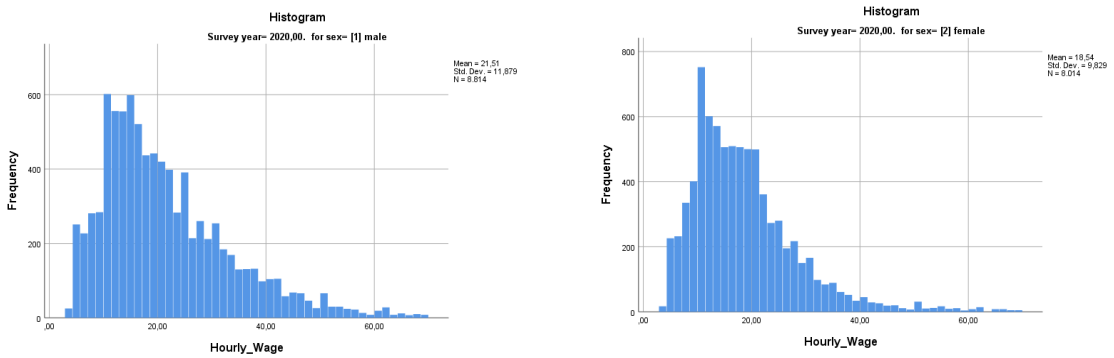


Figure 12 Gendered wage differentials 2020 (own illustration)

The second step will be to determine which predictors of wage inequality have been present before the Covid-19 pandemic and its associated consequences took hold. Comparing how these factors influence the dependent variable, namely gross hourly wage, will be the main contribution to research of this paper. Based upon the theoretical work of the effect of the lockdown measures undertaken in section 2, there are multiple themes which can be identified.

4.3.2 Human capital variables

Embarking on the first group, the predictor variables will be presented in a similar hierarchy as they were in the theoretical section, as this will likely ensure better understanding as well as coherence with the literature that has been presented. Revisiting the baseline model from Mincer (Mincer 1974), there are two main drivers that determine the probable wage a person will earn when applying the human capital approach. On one hand, there is education and, on the other, experience on the labor market. Commencing with education, there are many different facets that can be taken into account. One of the main aspects that has to be addressed is the appropriate combination between measures of quantity and quality of education (Le et al. 2005). That is because the sheer number of years of education does often not give any indicator as to what quality and thus earning prospects different types of schooling will provide. It is therefore advisable to incorporate the total number of years in education in combination with measures for the type of schooling, e.g., the highest achieved degree or diploma as well as a distinction between qualifications for certain fields or levels of employment that incur higher wages.

Quantity of education

When consulting the data, it becomes apparent that the sample for 2019 is quite homogenous in terms of years of education between genders, while women even have a slight advantage over men with a mean of 12,26 years of total education in comparison to 11,93 years that the male respondents of the sample have received. This does not come as a surprise however, as it has been mentioned before that women have strongly caught up to male education levels in the last 30 years and have even started to outperform their male counterparts when it comes to university degrees (Gallego Granados and Wrohlich 2018).

It would still be interesting to see, whether the number of years of education factor differently into the wage-earning capabilities between men and women, which would indicate that men might invest their time in education in a more profitable way and pursue schooling that allows for higher paying jobs, while women pursue a career path that might provide social welfare for the community but not personal financial gain. After revisiting other works in this field, it has been decided to not include the quantity of education into the final regression analysis in favor of qualitative measures. For completion reasons, it still remains included in the data descriptive.

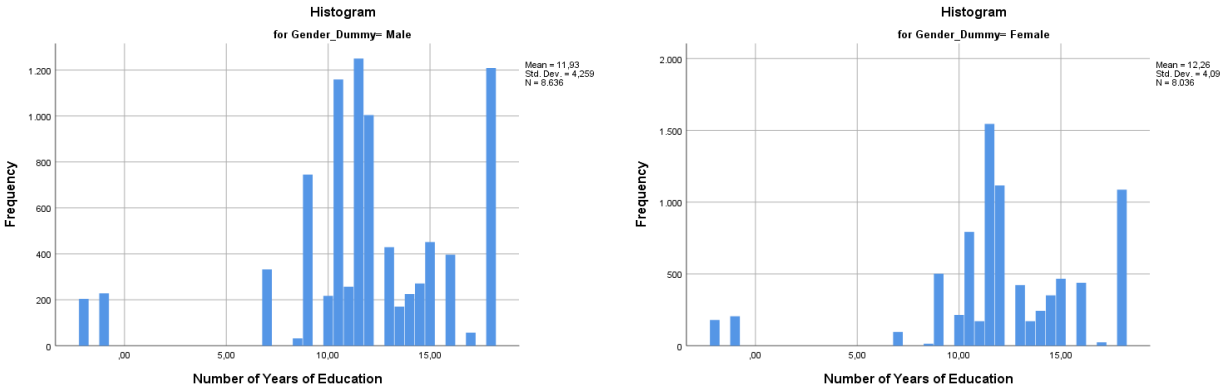


Figure 13 Years of education 2019 (own illustration)

Quality of education

To gauge how education features into the human capital wage earning equation, a common measure for quality of education will be introduced into the dataset. The CASMIN classification is a well-established and adaptive scale that has been used various times in empirical research (Müller et al. 2020; Kogan 2004). Its main advantage over the sheer quantity of years of education is firstly, that it outlines the hierarchy between different levels of education (elementary, secondary, tertiary), the ascribed value of certificates of graduation of these levels and the necessary intellectual capabilities to obtain them. Secondly, it distinguishes between general education and vocational schooling, which plays a huge role due to the duality of training in the German labor market (Müller 2000). The CASMIN classification features three main groups (Brauns and Steinmann 1999). The first group, group 1, features the lowest level of educational attainment, which is "inadequately completed general education, general elementary education as well as basic vocational qualification. For the German system, this would roughly translate to leaving school without a degree, leaving school with a "Einfacher Schulabschluss (ESA)" and leaving

school and completing a basic apprenticeship. The second group features intermediate general education ("Mittlerer Schulabschluss (MSA)", "Fachabitur") as well as the intermediate vocational qualifications that are usually obtained with these types of degrees. The highest tier of the second level are the full maturity certificates ("Abitur") that qualify for obtaining a college education. This brings us to the third tier, which is the tertiary education, which again is divided into two subgroups. We have the lower tertiary education, which encompasses all types of bachelor's degrees from technical colleges as well as universities, and the highest division of educational attainment, which would be diplomas as well as master degrees obtained from institutes of higher education such as universities, colleges etc. (Schneider 2016). Taking a gaze at the explorative data analysis, one can see that women have a slightly better average with a CASMIN score of 2,13 in comparison to men with a score of 2,05. There is however a strong preference in males to opt for basic vocational qualifications, as many male jobs such as working in construction or mechanics are attainable with such an apprenticeship. There are also relatively more males that appear to complete a higher tertiary education, which would coincide with the assumption that women do not pursue university education at the highest level due to constraints between fertility/motherhood and the human capital investment (Daugherty 2012).

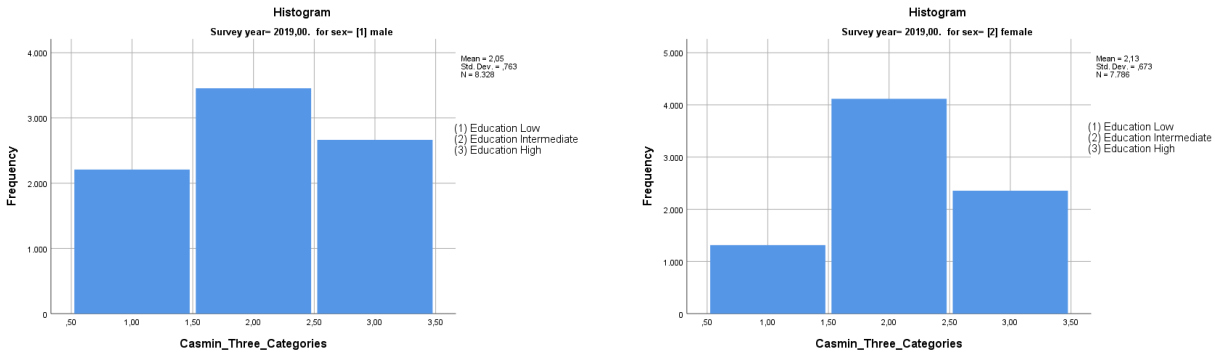


Figure 14 CASMIN Classification (own illustration)

Field of education

It is not only the completion rates of higher education which are of interest to this research, but also the area of studies which can have an immense effect on income. As mentioned in the section about education in the theoretical groundwork, the higher university completion rates of females are somewhat offset by the choices of college majors that men and women are venturing into. This choice is suspected to be either due to innate abilities

or preferences or even a mix of both, there is however a huge wage premium attached to the choice of certain college majors. In the United States for example, an engineering graduate will earn 40% more income than a graduate of educational studies (Zafar 2013). The data present has been grouped in a similar fashion as it has been done by Sloane et al., namely into typical fields of latter employment to provide comparability (Sloane et al. 2021). In the sample, one can observe that from the participants that have obtained a college degree, there is still a highly gendered selection of field of college major, e.g. women pursuing educational studies, while men venture into engineering. Business seems to attract both genders in an equal fashion, probably due to its relatively flexible prospects in the labor market after graduation, but it is not a strong indicator as to how it affects later earnings, as these can vary strongly on the specialization chosen.

On further inspection, there is still an immense oversupply of male engineering students as well as physical science studies majors. Knowing that the STEM fields tend to result in higher pay, these findings support the hypothesis that even before entering the labor market, the choice of the educational field does highly impact later earning prospects. The data also shows that while women have ventured into traditionally male territory, there is low to no interest of male students to take up more female dominated areas of studies. This corresponds to a larger trend where gender equality is not actually advanced by men compromising on their dominant position, but women fortifying their equality by owned initiative. Due to the rather small portion of sample participants which have supplied an answer to this questionnaire question, this variable has also been excluded from the regression model for reasons of validity.

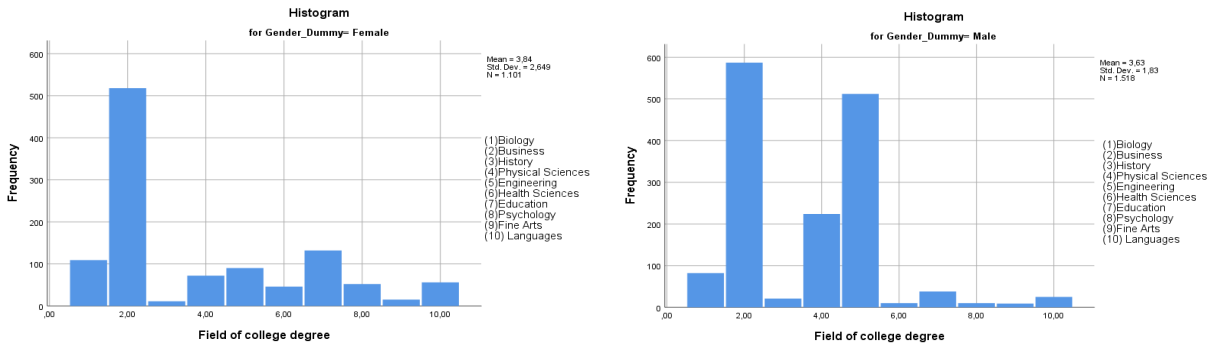


Figure 15 Field of college education (own illustration)

Experience and on-the-job training

Having covered the educational part from a quantitative as well as qualitative perspective, the focus will now shift towards the second part of the Mincer equation, namely labor market experience and on the job training. While the human capital earnings function is conducted by using potential working experience as a measure, the longitudinal nature of the SOEP dataset provides the firm tenure as a proxy as to how much labor market experience a person has received. This will provide a better approximation than the traditional method of subtracting the education as well as the age at the start of schooling from the current age, as is common place in studies where there is no obtainable data about actual work experience (Mincer 1974). In the sample from the SOEP, it is possible to observe the working experience that the respondents have received at the point of the interview. Experience as well as firm tenure does unsurprisingly have a different effect on the wages of men and women. Research finds that because women's career paths are a lot more dependent on lifecycle events such as childbirth, they have higher returns on wages when it comes to general working experience than men. That is because women are a lot less attached to their employer, as a significant number of women enters their first employment with the assumption to be out of the labor force at 35 due to family-related reason, an expectation that they do not share with their male counterparts. It thus makes more sense for females to gather broad working experience that is transferable, as a linear career within one firm is less likely and a broad skillset allows for an easier reentry into the labor force than firm specific training. In addition, once again discriminatory practices by the employer's side might play a role, as there can be a selection bias towards choosing prospects for a highly specific intrafirm career. It can be assumed that employers are less likely to select a women, as they suspect less attachment to the employing firm and thus increased opportunity costs in comparison to choosing a male candidate (Munasinghe et al. 2008). So even though working experience does benefit women, they still strongly lack behind men in accumulating it. Considering that the average age of the sample is around 44 years of age for both men and women, it is astounding to see that men have almost eight years more working experience than women do on average. While there is a need for statistical validation, it can be assumed that a large part of that forgone experience is due to the so-called motherhood gap. It is therefore probable that the child-bearing penalty explains a large part of the wage discrimination that females face in the labor market (Gallen 2018).

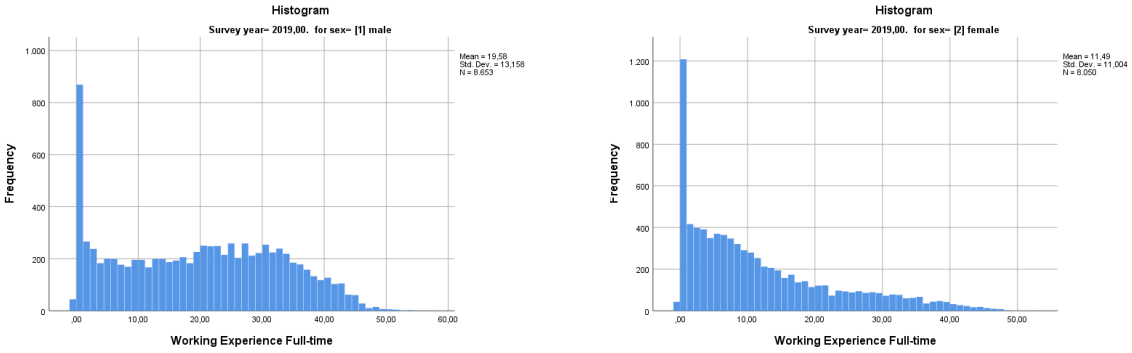


Figure 16 Working experience full-time (own illustration)

Firm tenure

Elaborating on the argument made before, the second measure to be surveyed is the within-firm tenure, as this is assumed to be a very potent attribute when it comes to estimating returns on human capital investment. Here, men do have a crucial advantage of their female competition and thus anticipate much higher returns. Theory suggests that because of the anticipated interruptions in female labor market participation due to childbirth, rearing and caretaking, women tend to invest in more general skills that are transferable between occupations instead of firm-specific knowledge and experience, which later gives them a penalty in wages.

For the same reason, it is indicated that men are less likely to leave their jobs and choose a different company or occupation, as they are much less likely to drop out of employment for fertility reasons (Ioakimidis 2012). The outcome in the sample would back this assumption, as men do show a higher firm tenure of about one year in comparison to the women surveyed.

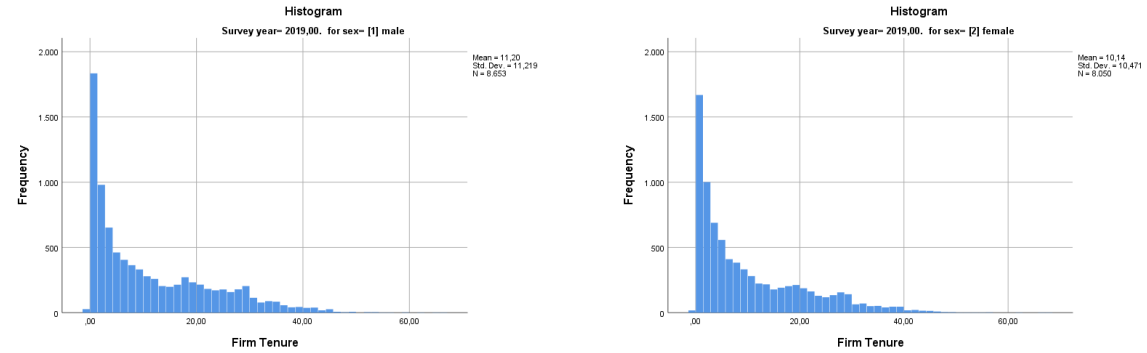


Figure 17 Firm tenure (own illustration)

Employment status

The following collection of variables can be labelled as *changes in employment situation*, where a potential situation of unemployment as well as a reduction of working hours, either due to STW or voluntary arrangements will be assessed. This will be assessed by comparing not only the proxy for unemployment, but also any variations in the weekly hours worked or changes from e.g. full-time working schemes towards part-time models. Further disadvantaging women, there is evidence that not only breaks in the accumulation of working experience and firm tenure incur wage penalties, but also working in a part-time arrangement. This can broadly be explained by three factors. First, human capital accumulation slows down significantly when switching from a full-time to a part-time schedule, which is commonplace when women return from maternity leave back into the workforce. Second, when women or men have worked part-time, there may be scarring effects, meaning that employers associate their former employment status as either a sig-

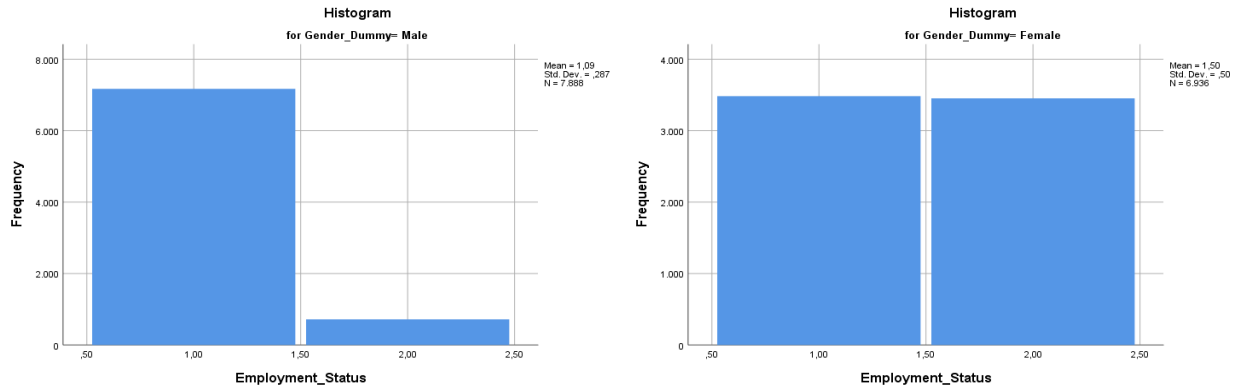


Figure 18 Employment status (own illustration)

nal of low productivity or low attachment to the labor force. Both assumptions would incentivize the employer to offer lower wages as well as less promising career paths due to this not necessarily true perception. Third, downgrading to a part-time arrangement might coincide with fulfilling tasks that are rather low skilled, which persist even when the individual returns to a full-time position, thus resulting in lower wages (Biewen et al. 2018). The figures from the sample illustrate why these penalties and stigmatization for part-time work are an immense disadvantage to wage equality. While the female sample is almost equally employed in full-time (1) and part-time (2) positions, the male group is almost entirely employed in full-time positions, thus avoiding any possible penalties on their income.

Unemployment experience

As much influence as the working experience has on wages, the effects from being unemployed for a stretch of time are also diverse and complex. There appears to be a distinct form of scarring, where being unemployed drastically increases the chance for future unemployment and significantly decreases any future earnings and career paths, leading affected individuals into a cycle of low-paid and precarious employment. In addition, from a human capital perspective, there occurs a loss of firm specific experience as well as a deterioration of general skills of the labor market (Arulampalam 2001). In direct relation to wages, individuals that have been unemployed loose a significant amount of bargaining power when it comes to negotiating their wage with future employers. Their reservation wage will also change, as they become willing to accept a lower salary in order to get back in the labor market as soon as possible. In general, especially long stretches of unemployment seem to affect female wage earning prospects a lot more than males (Baffoe-Bonnie and Ezeala-Harrison 2005). In the sample present, women also appear to have a higher average number of years in unemployment experience with 0,87 compared to 0,70 in males, likely affecting their income in the short and long term.

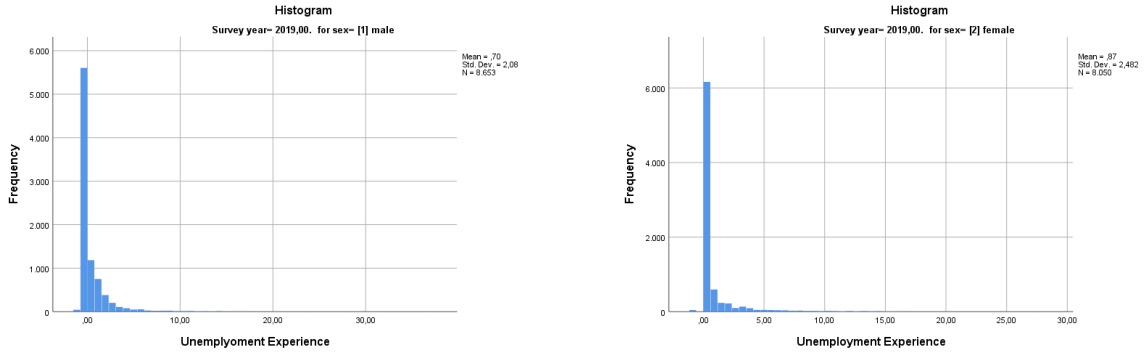


Figure 19 Unemployment experience (own illustration)

Hours worked in a week

Another important aspect that factors into different pay for genders is the difference in actual hours worked. Similar to part-time work, lower working hours are sometimes perceived as a proxy for lower worker productivity and thus decreased pay. Goldin argues, that especially in occupations where men and women would have similar chances of pursuing a successful career, the best positions are “the winner takes it all” positions, such as partner in a law firm or a top manager in a large corporate entity. Putting in many hours

might significantly increase the chance of obtaining such a position and the wage associated with it. Supplementary, there are occupations in which having a flexible schedule,

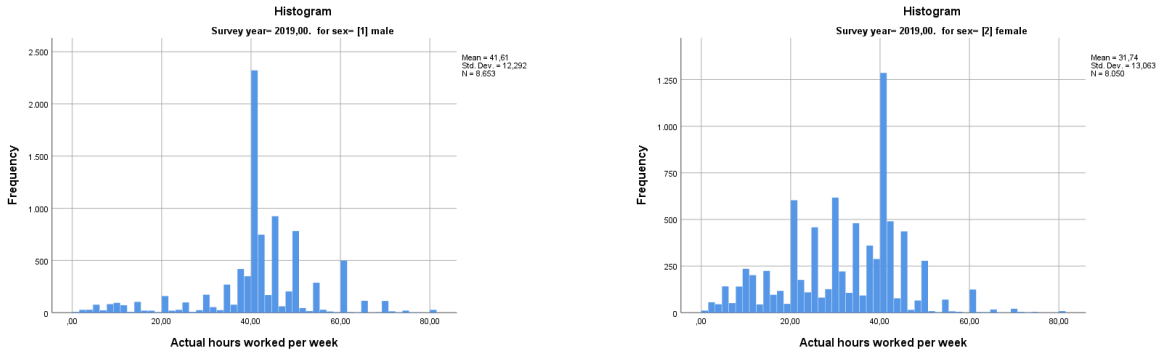


Figure 20 Actual hours worked per week 2019 (own illustration)

such as a mother that works part-time, is seen as a disadvantage, because the particular time at which hours are brought in also counts, this is especially true for the corporate world (Goldin 2014). In the data for this paper, it can be witnessed that women work significantly less than men on average and their appetite for extensive working hours that exceed 60 hours is a lot less pronounced than their male counterparts. It might just be exactly these hours that grant the men a deciding edge in terms of career development and income that the women have to sacrifice on in order to allow for a flexible schedule that accompanies the arrival of children in the home.

Interestingly enough, in 2020 males have slightly reduced their actual hours worked while women have gained around an hour more per week. This effect could mirror the observations that a significant number of men have taken advantage of teleworking flexibility and thus increase the hours spent working in the household while reducing working hours for their job. At the same time, women profit from being able to work from home, as this gives them more flexibility and facilitates uniting domestic and professional duties (Carli 2020).

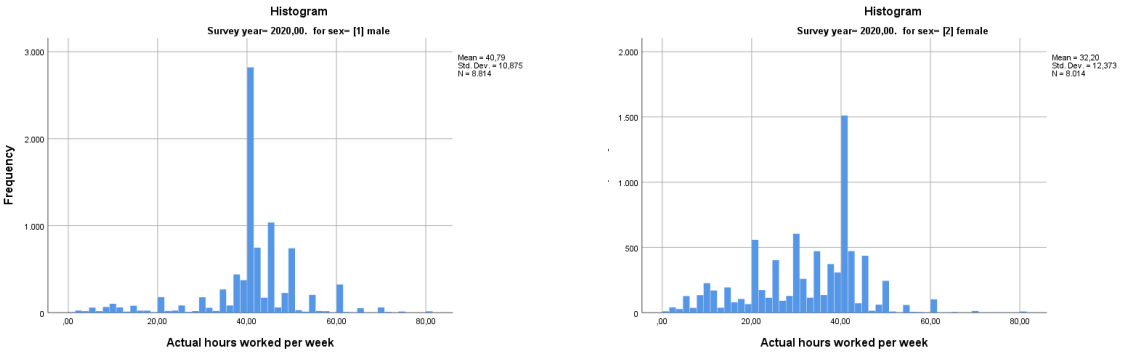


Figure 21 Actual hours worked per week 2020 (own illustration)

4.3.3 Occupational variables

Advancing from the human capital approach and drawing on the literature provided, the research will now take into focus the occupational wage gap. As has been shown, women have been able to catch up significantly in the last decades in terms of human capital accumulation and even overtaken men in certain areas of education. On the threshold between qualification and the working world however, there are still strong segregation forces at work, characterized as the "allocative discrimination" at the matching point of hiring (Petersen and Morgan 1995). This encompasses much more than just the sheer job that an individual is working in, as it has been shown that industry, size of the firm as well as employment in the private or public sector do influence wage differentials between men and women. Departing from the two most defining variables, industry and occupation, a similarity to the education discussed earlier can be drawn. Much like quantity and quality of education are inseparable, the connection between what a person works as and where it works are strongly interrelated when it comes to how much income is derived.

Occupational sector (ISCO-08)

As has been explained in detail in the theoretic section, there is little doubt about a present occupational segregation between genders on the German labor market. For example, there are jobs which are considered as a typical male job, such as construction industry, or typical female jobs, such as nursing and early childcare as well as education (Humpert 2014). In the social sciences, a common framework to be used is the ISCO-08 classification, that groups occupations into 10 different major groups, being: 1 = managers, 2 = professionals, 3 = technicians and associate professionals, 4,= clerical support workers, 5 = service and sales workers, 6 = skilled agricultural, forestry and fishery workers, 7 = craft and related trades workers, 8 = plant and machine operators, 9 = elementary occupations, 0 = armed forces. (ILO 2012) The results of the explorative data analysis show similar distributions to what prior research has claimed. There is a high percentage of women in so called white-collar jobs, that is managers, professionals, and technicians, so group 1 to 3. This stems from the fact that many women work in education and healthcare, which are typical public domain jobs that usually pay fair loans but not high premiums, like private sector jobs tend to do. This will also be discussed in more detail in the following para-

graph. For males, we see a high concentration in craft and trades as well as plant and machine operators, which are rightly considered as traditional male occupations by science (Anspal 2015).

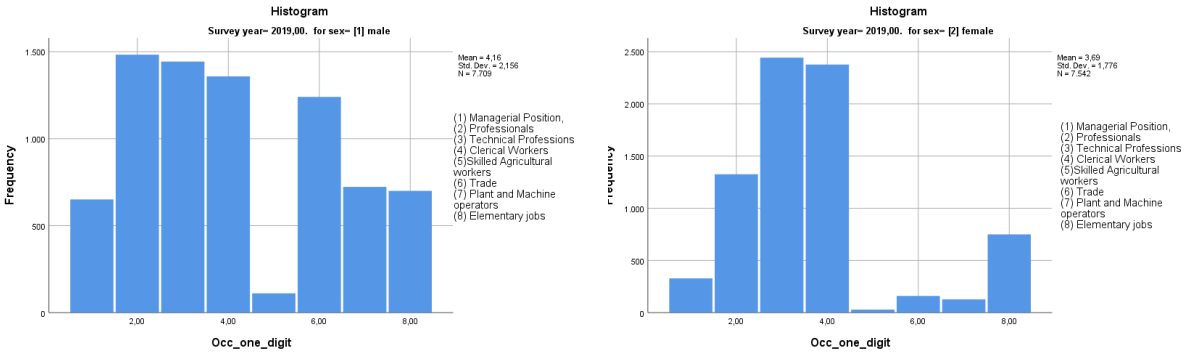


Figure 22 Occupational status (own illustration)

Industry (based on NACE classification)

It is considered common practice to include at least one digit industry control measurables in gender wage gap research and data with added specification in accordance with the subject of the study. For this case, a combination of a general classification shall be used to assess overall industry effects as well as an additional emphasis on industries that are vulnerable to Covid-19 impairments as well as predominantly female staffed. Embarking on the general distribution in the sample, a strong accumulation of female employment in the service sector that includes healthcare and educational services becomes visible. This also relates to a theme that will be explained in more detail later, as these areas are often under public administration, which means governmental fixed wages (Anspal 2015). Men on the other hand are much more dominant in manufacturing, construction, and trade, which are considered as traditional male industries.

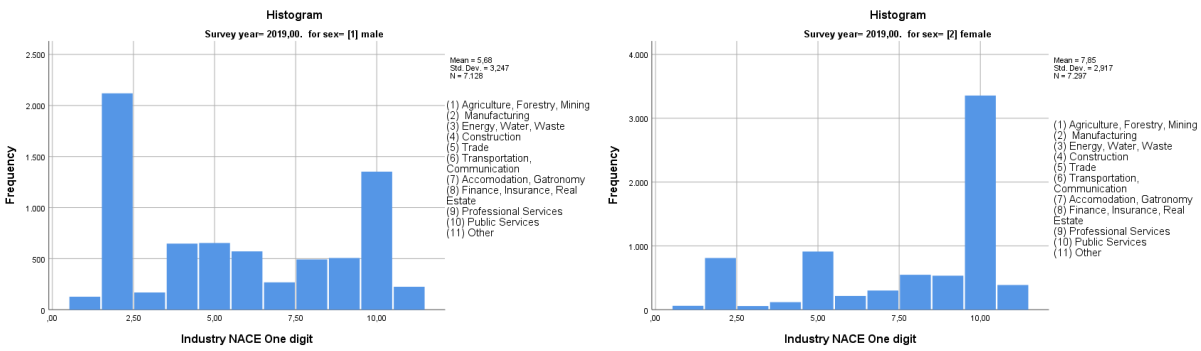


Figure 23 One-digit Industry classification (own illustration)

A very interesting nuance in terms of industry segregation is the presence of females in areas that have been qualified during the Covid-19 pandemic as frontline workers. This implies on one hand that women have endured the brunt of the increased strain of the Covid-19 pandemic in healthcare, childcare institutions as well as grocery stores while at the same time being overrepresented in industries that suffered massive layoffs, such as gastronomy, services and tourism (Tucker 2021). Again, it seems that female employment could carry many indirect penalties apart from sheer pay.

Public vs. private sector

In addition to the industry segregation, the very unequal dispersion between genders in private and public sector employment is also a point of interest to this study. The research is inconclusive how exactly the larger representation of female workers in the public sector factors into the gender wage gap, but there is evidence that it is strongly interacting with labor market dynamics in general. While the private sector wages are usually defined by market dynamics, the public sector wages are regulated by political law making (Castagnetti and Giorgetti 2019). This would imply that public sector employment is beneficial to female earnings, as there tends to be better anti-discriminatory regulation in place, wage-setting is more transparent and egalitarian conditions for employment are enacted faster. While highly educated men fare better in private sector employment, the rent-seeking is highly favorable in the public sector for women, as this also allows for a more risk-averse form of employment (Zweimuller and Winter-Ebmer 1994). There is room for concern however, as the need for austerity politics is threatening the size of the public sector and calls for privatization of public services, thus endangering a vehicle of female equality (Jill Rubery 2013). As the data goes on to show, in the sample present there is also a high overrepresentation of women in jobs that qualify as a civil servant (1), which would mean public sector employment. The results of the multiple regression will show how this affects income in this sample specifically and thus, further conclusions as to how exactly the private public segregation in Germany interacts with the gender wage gap can also be drawn.

Firm size

In addition to the contents and the industry of the workplace, there is another characteristic that does play into wage dynamics, which is the size of the firm. Usually, large firms are seen as mitigating wage inequality, because they pay their lower and middle employees not significantly less than they do their high paid staff. Also, employees of larger firms tend to earn more than they would at smaller organizations, which is called the firm size wage effect or FSWE (Cobb and Lin 2017). In addition, landing the first job at a larger firm is associated with higher lifetime earnings, more productivity as well as better career development possibilities for the future, all of which greatly influence the wage dispersion (Arellano-Bover 2020). In the sample data, men and women are employed on average in quite similar size firms as well as similar levels of self-employment, the visible difference is that more men seem to work in smaller firms between 20 and 200 employees, which might again be a representation of men working in construction, trades, and vocational occupations.

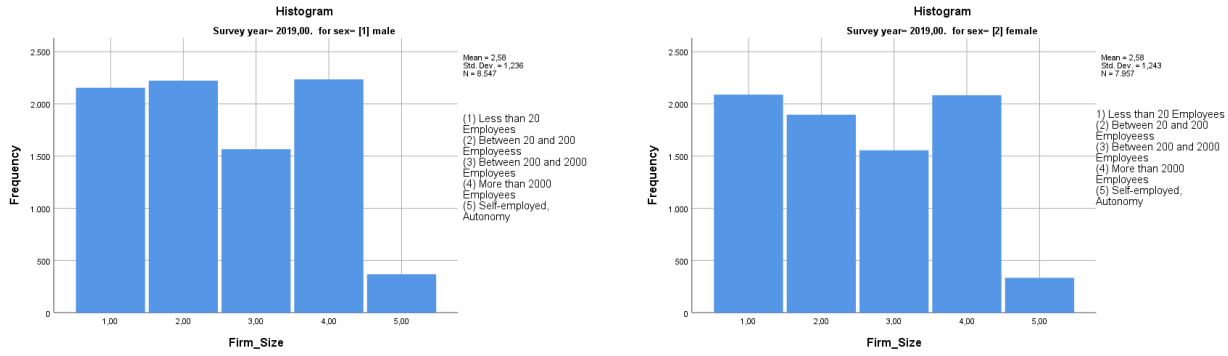


Figure 24 Size of the company (own illustration)

4.3.4 Domestic tasks variables

Moving from the professional towards the private domain, this area will likely contribute a lot towards the explanation on how the wage gap has changed because of the Covid-19 pandemic. During the lockdowns, there has been an immense immersion of work into the

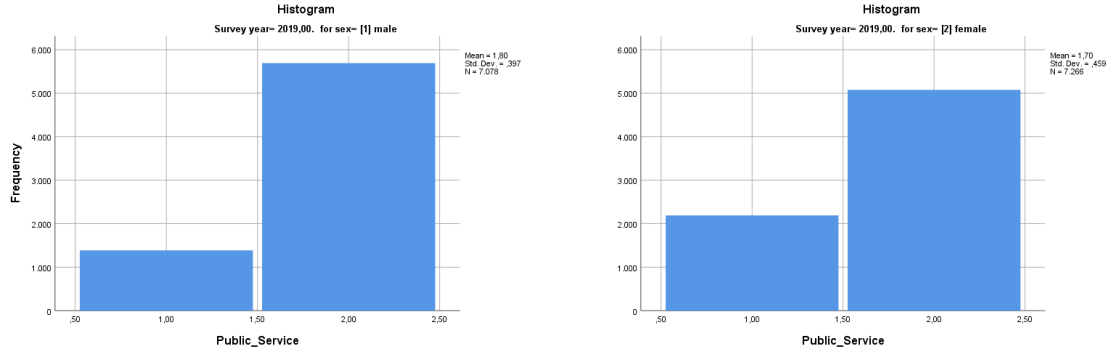


Figure 25 Public vs. private sector (own illustration)

domestic sphere, as the social distancing measures forced people to stay and work from home. This change disrupted societal patterns that people had grown accustomed to, as demand for childcare and housework duties increased drastically due to closures of the providing public institutions as well as the service industry. This is problematic, as even before the limitations of social distancing, domestic tasks such as cooking and cleaning were primarily done by women, a trend that could likely have seen a reinforcement during the last two years, much to the dismay of female earnings (Boo 2021).

Hours per weekday spent on housework

Even though women have made advances in the last thirty years in terms of wages as well as education and labor force participation, they still carry most housework responsibilities, a far larger portion than men. Interestingly enough, there are two main strands of explanations discussed by scholars relating to this askew division, both of which show exceptions to the rule, however. The first argument is resource allocation, where men have supposedly higher income and thus a better bargaining position when it comes to labor division within the household. Still, in households where both partners earn a similar amount, women outperform men in domestic duties. Second, women are less present in full-time employment, which frees them up to take over tasks that are considered as unpaid labor in the home. Yet, in household where the women is the main source of income and employed full-time, they tend to still do more relative housework in comparison to their partners (Thébaud et al. 2021). Evaluating the sample from the SOEP for 2019, it becomes evident that the gender household gap is far from being closed. Women surveyed have worked almost double the hours their male counterparts have invested in domestic chores, around 1,67 hours a workday, which means that the extra work carried out on weekends is not yet even incorporated in that estimate. The burden that females carry by investing this much of their time into housework is likely a core determinant of the changes that can be witnessed during the confinement to the own home experienced during the Covid-19 lockdowns.

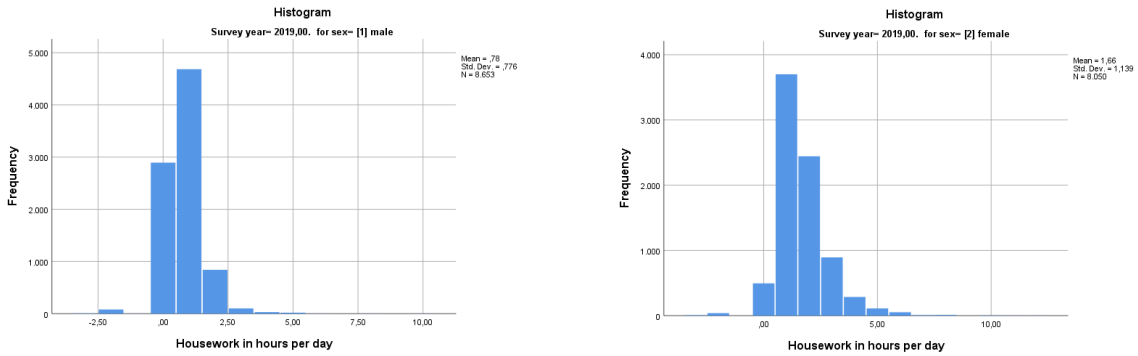


Figure 26 Hours of housework daily 2019 (own illustration)

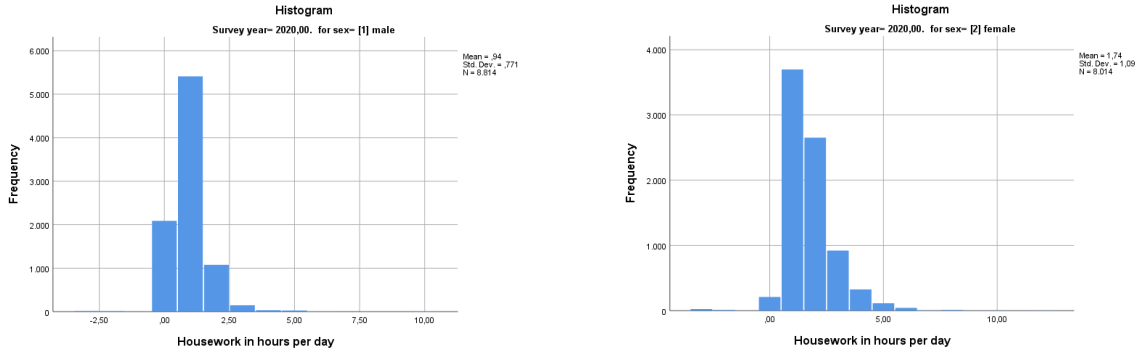


Figure 27 Hours of housework daily 2020 (own illustration)

Hours per weekday spent on childcare

Nonetheless, there is another large share of unpaid work that falls mostly to the female side of the household, the rearing of children or childcare. While this has also been an area where females are strongly involved from a traditional perspective, primary research of the implications of the Covid-19 pandemic have not found evidence for a macrolevel shift of responsibilities. Again, literature is pointing towards an entrenchment of division of labor, where women that had already been the primary caretaker have now taken on even more of the responsibility (Hank and Steinbach 2021). On the other hand, another school of thought is opposing this "backlash" phenomenon, as it claims that the lockdowns are rather proving as an opportunity for "convergence" as more fathers are able or forced to work from home, which allows them to participate on a more frequent basis in the family life and thus in taking care of the children as well (Boll et al. 2021). In another paper, Boll and Schueller identify "working from home" as well as "systemic relevance" as two of the main drivers for changes in share of paternal childcare, which is illustrated in the following figure. It is assumed that these two factors strongly change income and time allocation

within couples and thus are able to influence the division of labor in the home in the long term (Boll and Schüller 2020).

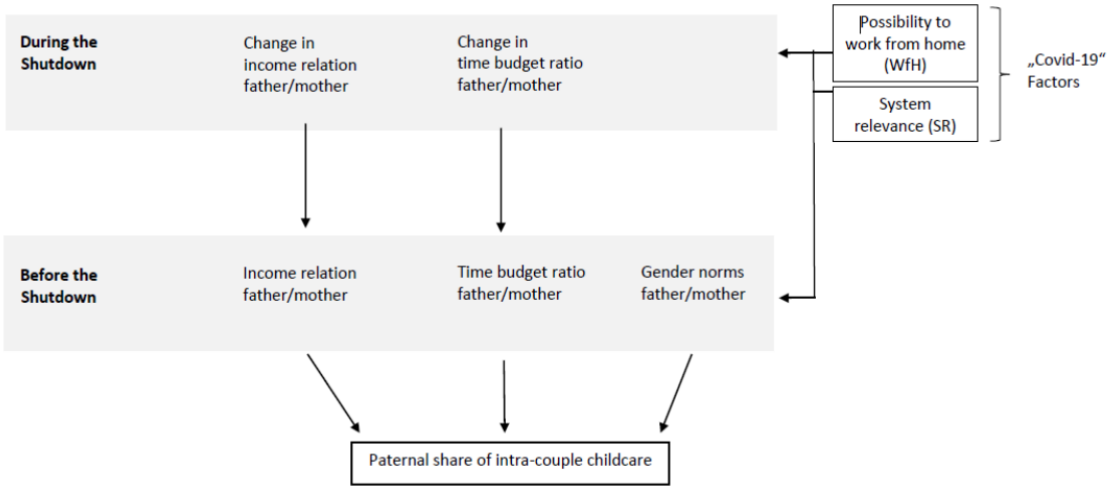


Figure 28 Paternal share of intra-couple childcare (Boll and Schüller 2020)

While this hypothesis can only be evidenced in the long run, the data available will allow for a glimpse at the short-term changes that were brought about as well as for the implications these changes have had on the gender wage gap. As for the pre-Covid-19 data, women again have more than double the share in terms of hours than their male equivalents when it comes to taking care of children.

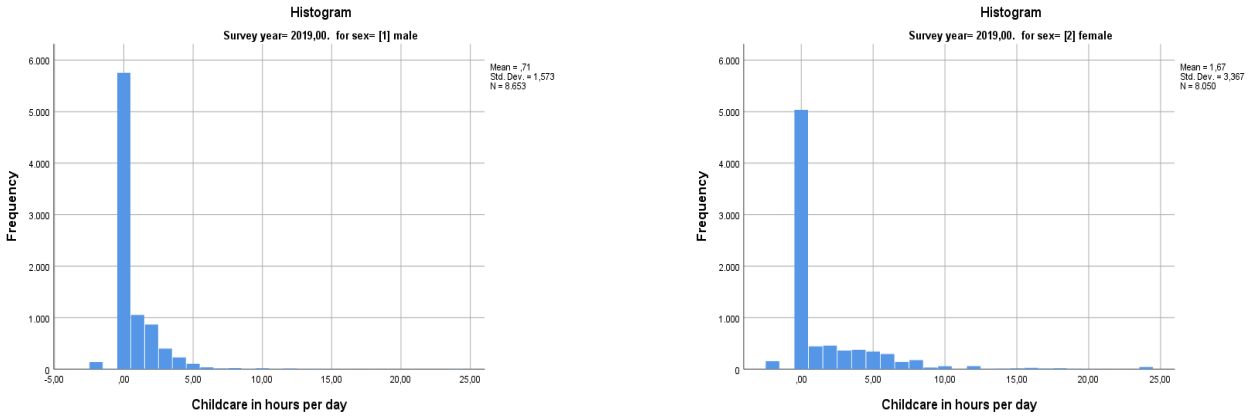


Figure 29 Hours spent on childcare daily 2019 (own illustration)

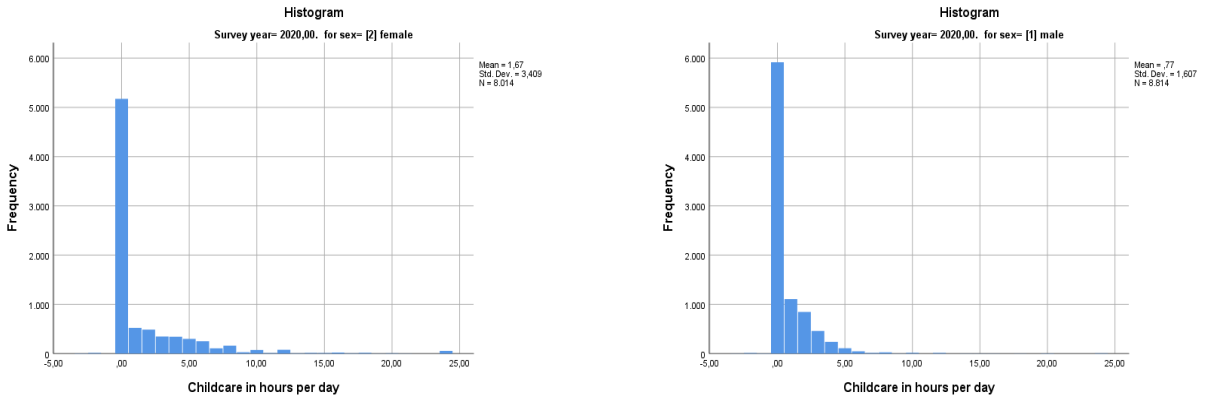


Figure 30 Hours spent on childcare daily 2020 (own illustration)

Number of children in household

Adjacent to the hours which are invested in taking care of a child, it is advisable to survey how many children are present in the household. This way, one can gauge how much a child is affecting its parents' earnings according to their respective gender, and whether the expected wage penalties for men and women are comparable. Research is quite conclusive that there is such a phenomenon as a "motherhood-gap", which means that women with children earn not only less than men, but also less than their peers without a child. In addition, the number of children is seen as an accurate proxy for forgone work-experience as

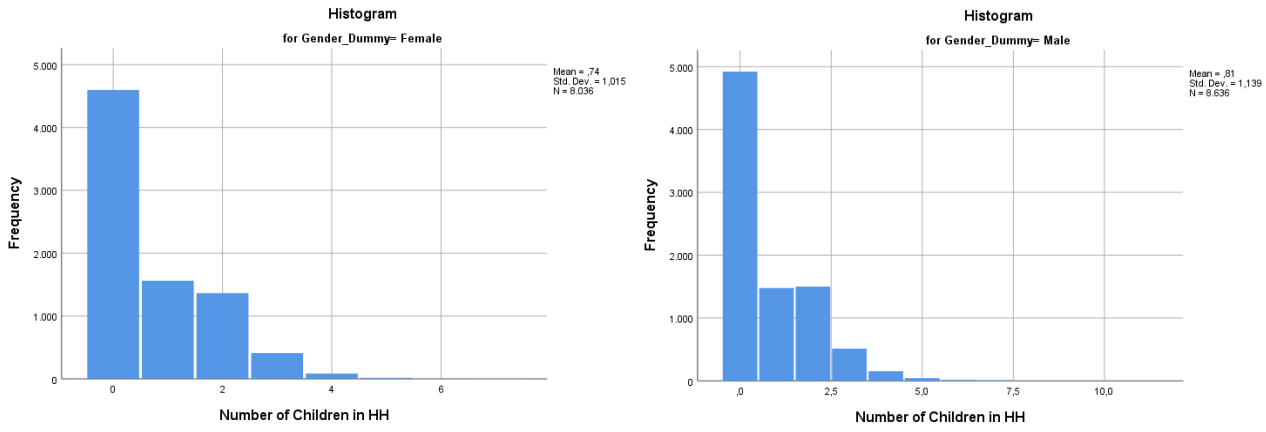


Figure 31 Number of children in the household (own illustration)

well as the attachment to the labor force, more so than the sheer fact of being a mother, which makes the incorporation of this variable a viable endeavor (Amuedo-Dorantes and

Kimmel 2005). Applying this logic to the sample at hand, the number of children present in the household is, to no surprise, more or less the same between genders.

4.3.5 Control variables

Apart from the variables that have been introduced to far, it is necessary to include a handful of control variables, which while they might interact with wages, are still not considered as the core predictors of interest in this study. Including them will still make the model more complete and give a more realistic approximation of the factor strength of the proxies which are of principal interest.

Age

The age of the participants of the survey plays an important role, as different age groups reflect the changes of the gender wage gap on the labor market over time. Older participants may have started working in a highly segregated labor market, while younger generations might already profit from the narrowing of the gender wage gap over the years and

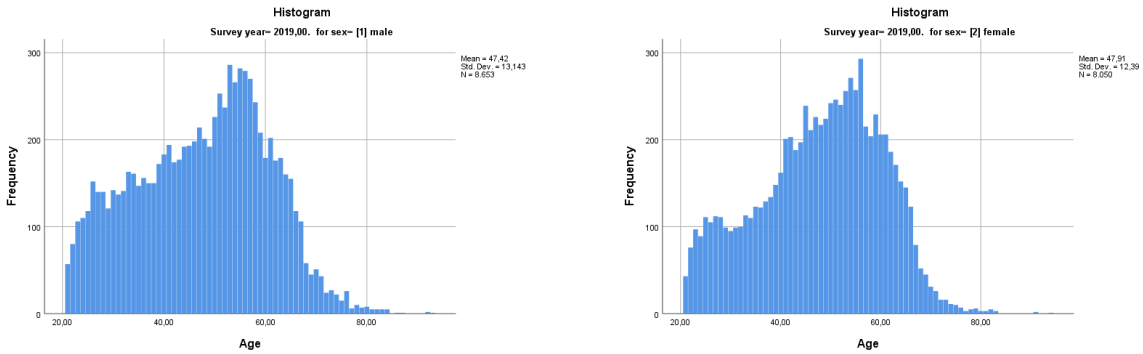


Figure 32 Age of individuals (own illustration)

join a much more egalitarian labor market (Hegewisch et al. 2010). In addition, age correlates strongly with work experience and thus wages are expected to rise with growing age as well (Li et al. 2013). This variable is interacting with almost each of the other variables, be it the years of education, the number of children or the chances of being married, all these characteristics are usually pertinent to a certain age group. The sample of the SOEP for 2019 is quite equal in its age distribution, as both male and female participants are around 47 years old.

Marital status

As if the general gender wage gap weren't enough, there is another disadvantaging phenomenon, called "the marriage gap". Across countries, there is evidence for a wage premium of married individuals over unmarried ones, a fact that especially benefits married men. For women, the marital status can have varying effects on income, depending on factors like human-capital as well as household structure (Geist 2006). While the motherhood gap, a wage penalty on bearing children for women, has been thoroughly researched and evidenced, the effect of marriage is more inconclusive. On one hand, according to Geist, women are likely to lose individual income but at the same time gain a higher household income by getting married. But while men's labor market productivity increases by joining a marriage, as this usually reinforces traditional gender roles in terms of housework and childcare and thus allows them to focus more on work, women are taking the flipside of this arrangement. What makes marriage a difficult proxy for earnings, however, is the selectivity approach. The main question that is to be asked here, is whether being married (1) increases wage-earning probabilities, or whether high wage-earning probabilities do increase the prospects of finding a partner for marriage. Research on wealth accumulation as well as re-employment benefits from marriage also show that while women do profit from a household perspective, they do not gain individual benefits in these areas from entering a marriage, while their male spouses do (Jacob and Kleinert 2014; Lersch 2017).

Migration background

Revisiting the basics of discriminatory research by Becker, discrimination can occur between any two groups (Becker 2010). For this sample and the case of Germany, it is therefore paramount to include the migration status of the respondents into the data to control for wage differentials between natives and Germans with a migration background. Based on research conducted on the SOEP data for that last two decades, the wage gap between foreigners or naturalized immigrant and German natives can be put anywhere between 17% and 10% (Ingwersen and Thomsen 2019). The reasons for this division are manyfold and too vast to delve into in great detail, but a few shall be discussed nevertheless, especially because of the similarities that can be drawn to the gender wage gap. For immigrants, differences in human capital factor endowment also account for a large penalty when it comes to income, as well as a lack of host-country specific knowledge like lan-

guage, customs and culture (Ingwersen and Thomsen 2019). In this context, it is also noteworthy that migrants in Germany tend to hold less egalitarian views when it comes to gender roles, which is partly due to religious beliefs and value systems (Diehl et al. 2009).

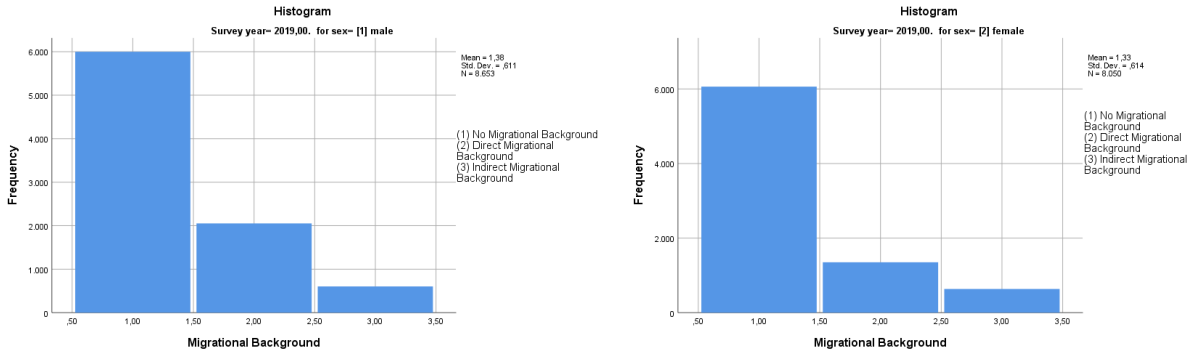


Figure 33 Migration background (own illustration)

Region

Even after more than 30 years, there has still not been a full transition between the reunified regions of west and eastern Germany that now make up the federal republic of Germany. Though they share a common market, similar education systems and the same regulations and laws for the labor market, there is a substantial wage gap between inhabitants of former west and east Germany, where the western laborers do earn a considerable amount more than their eastern coworkers, around 24% to be precise (Kluge and Weber 2018). According to Kluge and Weber, there are many factors that explain this chasm, among them the agglomeration of industries between regions, higher female work participation in the east, the size of firms as well as local price level differences. This work, however, does not thoroughly explore the underlying factors for the division between east and west in terms of wage, but it is necessary to include the regional differences into the regression model to correctly assess their implications on the gender wage gap.

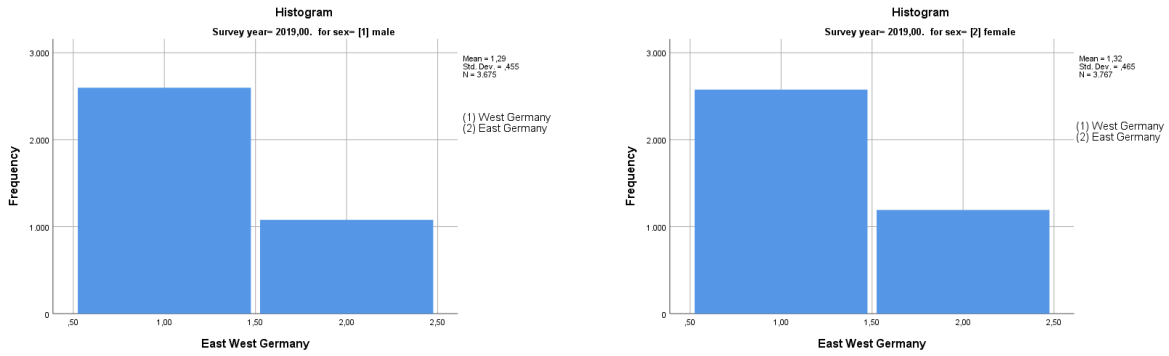


Figure 34 State of residence (own illustration)

4.4 Summary statistics

For reading purposes, the summarized statistics for the variables which are included in the regression are displayed beneath. This should facilitate overview as well as comparability.

Descriptive Statistics	**2019**				**2020**			
	Male		**Female**		**Male**		**Female**	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Log_hourly_wage	2,9270	0,57030	2,7665	0,51164	2,9187	0,56045	2,7920	0,50944
Hourly_Wage	21,8198	12,36137	18,1057	9,72997	21,5083	11,87904	18,5354	9,82853
Casmin Score *(Three Categories: 1 = low education, 2 = intermediate education, 3 = high education)*	2,0546	0,76303	2,1337	0,67336	2,0619	0,76699	2,1558	0,67962
Firm Tenure	11,1965	11,21897	10,1387	10,47108	9,8628	10,80070	9,5408	10,28269
Employment Status *(6 Categories: 1 = fulltime employment, 2 = parttime employment, 3 = vocational training, 4 = marginal employment, 5 = no employment 6 = special needs employment)*	1,3095	0,76695	1,8124	0,92593	1,3007	0,74544	1,7687	0,89587
Working Experience Fulltime	19,5822	13,15825	11,4947	11,00410	16,5450	13,91068	10,3437	10,97369
Unemployment Experience	0,7010	2,08050	0,8651	2,48245	0,5329	2,08601	0,7245	2,44024
Occupation ISCO One Digit *(8 Categories: 1 = Managerial Position, 2 = Professionals, 3 = Technical Professions, 4 = Clerical Workers, 5 = Skilled Agricultural workers, 6 = Trade, 7 = Plant and Machine operators, 8= Elementary jobs)*	4,1554	2,15589	3,6885	1,77644	4,1487	2,13307	3,6387	1,73890
Industry NACE 2,0 One Digit *(11 Categories: 1 = Agriculture, Forestry, Mining, 2 = Manufacturing, 3 = Energy, Water, Waste, 4 = Construction, 5 = Trade, 6 = Transportation, Communication, 7 = Accommodation, Gastronomy, 8= Finance, Insurance, Real Estate, 9 = Professional Services, 10 = Public Services, 11 = Other)*	5,6820	3,24704	7,8479	2,91738	5,7727	3,23265	7,9100	2,90397

Firm size (5 Categories: 1 = Less than 20 Employees, 2 = Between 20 and 200 Employees, 3 = Between 200 and 2000 Employees, 4 = More than 2000 Employees, 5 = Self-employed, Autonomy)	2,5394	1,29054	2,5410	1,29330	2,5465	1,30089	2,5339	1,28291
Housework per weekday	0,7768	0,77571	1,6630	1,13892	0,9408	0,77102	1,7406	1,08951
Childcare per weekday	0,7073	1,57328	1,6709	3,36708	0,7703	1,60716	1,6693	3,40934
Public service *(2 Categories: 1 = Public Servant, 2 = Private Sector)*	1,2927	1,14230	1,4347	0,91482	1,4427	1,00699	1,4890	0,84508
Gender	1,0000	0,00000	2,0000	0,00000	1,0000	0,00000	2,0000	0,00000
Migrational Background *(4 Categories: 1 = No Migrational Background, 2 = Direct Migrational Background, 3 = Indirect Migrational Background, 4 = Migrational Background N.A.)*	1,3764	0,61148	1,3257	0,61436	1,4479	0,60686	1,3666	0,61074
Region East West Germany *(3 Categories: -2 = does not apply, 21 = West Germany, 22 = East Germany)*	7,8929	11,51835	8,9109	11,63931	7,0117	11,34871	8,1642	11,56838
Marital Status *(8 Categories: 1 = Married, living together, 2 = Married, living separated, 3 = Single, 4 = Divorced, 5 = Widowhood, 6= Partner in different country, 7 = Homosexual marriage, living together, 8 = Homosexual marriage, living separated)*	1,8807	1,22451	2,0537	1,30181	1,8867	1,23233	2,0686	1,29424
Valid N (listwise)	6722		6998		6169		6304	

Table 1 Summary statistics (own illustration)

4.5 Hypothesis

Recalling the assumptions made in the theoretical background, it appears that the Covid-19 pandemic will have an interlocking effect with the gender pay gap. The gender-pay gap, which has already been a pressing issue in society before the pandemic and government containment measures struck, has likely undertaken a dynamic evolvement due to the huge shifts in labor market dynamics caused by the Covid-19 pandemic. The conclusions that emerge from the literature research hint at a strong catalytic event, where the

implications of Covid-19 on the labor market interrelate with underlying determinants of female income and the gender wage gap. Amplifying and changing these determinants, the pandemic is likely to have a very strong effect on female income, which might worsen or even improve their position in the long run. The research question that is at the head of this work is therefore:

"How have the effects of the Covid-19 pandemic served as a catalytic event for income disparities between men & women in Germany?"

To answer this far from trivial question, it is advisable to articulate a hypothesis that enable to gather empirical evidence and evaluate the statistical outcome.

H1: The changes in the domains of work and domestic life that were caused by the Covid-19 pandemic have entrenched traditional gender gaps and therefore stalled or reversed a narrowing gender wage gap in Germany.

Leaning on all the literature evidence that has been presented, it would be expected that due to the Covid-19 pandemic, women will work more part-time, become unemployed, receive salary cuts due to industry downturn, increase their engagement at home, cook and clean more than ever before, all while taking care of the kids. These possible changes are more than likely to affect female income in a significant way and surely in a very disproportionate manner to their male counterparts. As mentioned in the theory however, there is a number of scholars that advocate a different picture. Women being essential frontline workers, profiting from short-term work arrangements, gaining flexibility to balance home and work due to teleworking advancements and fathers and partners working from home and sharing the burden of domestic duties might even have reduced the gender pay gap (Carli 2020). The gap therefore might have enlarged more between e.g. levels of education than gender, but it is yet hard to argue which direction female income will take in the long run due to the Covid-19 pandemic (Goldin 2022). Moving on, a statistical model will evaluate which of these events occurred and how female wages have developed during the lockdown due to the Covid-19 pandemic in 2020.

4.6 Regression model and results

In the following abstract, the regression model for men and women in the year 2019 and 2020, thus pre-Covid-19 and during Covid-19 will now be presented and evaluated, according to the coefficients of the factors in relation to the dependent variable, the log of gross hourly wages.

Regression Results	2019		2020	
	Unstandardized Coefficients B	Sig.	Unstandardized Coefficients B	Sig.
(Constant)	2,242	0,000	2,288	0,000
Education *(Base Category = Low_Education)*				
Casmin Score=Intermediate_Education	0,035	0,000	0,040	0,000
Casmin Score=High_Education	0,193	0,000	0,201	0,000
Working Experience				
Working Experience Fulltime	0,005	0,000	0,004	0,000
Unemployment Experience	-0,009	0,000	-0,009	0,000
Firm Tenure	0,009	0,000	0,009	0,000
Employment Status = [1] Fulltime employment *(Base Category = Parttime employment)*	0,168	0,000	0,184	0,000
Occupation *(Base Category = Elementary Occupations)*				
Managerial Position	0,474	0,000	0,436	0,000
Professionals	0,432	0,000	0,402	0,000
Technical Professions	0,225	0,000	0,216	0,000
Clerical Workers	0,078	0,000	0,059	0,000
Skilled Agricultural workers	-0,008	0,835	0,017	0,682
Trade	0,029	0,078	0,011	0,542
Plant, Machine, Mining	-0,005	0,780	-0,010	0,591
Industry *(Base Category = Manufacturing)*				
Agriculture, Forestry, Mining	-0,225	0,000	-0,217	0,000
Energy, Water, Waste	0,012	0,646	0,036	0,206
Construction	-0,062	0,000	-0,020	0,254
Trade	-0,141	0,000	-0,144	0,000
Transport, Information. Communication	-0,141	0,000	-0,144	0,000
Accommodation, Food	-0,246	0,000	-0,272	0,000
Finance, Insurance, Real Estate	0,045	0,002	0,040	0,008
Professional Services	-0,120	0,000	-0,116	0,000
Public Services	-0,119	0,000	-0,105	0,000
Other services	-0,183	0,000	-0,133	0,000
Firm Size *(Base Category = Less than 20 Employees)*				
Between 20 and 200 Employees	0,050	0,000	0,056	0,000
Between 200 and 2000 Employees	0,128	0,000	0,116	0,000
More than 2000 Employees	0,180	0,000	0,193	0,000
Self-employed, Autonomy	-0,031	0,076	-0,033	0,077
Control Variables				
Public Service 1 = Public Servant *(Base Category = Private Sector)*	0,041	0,000	0,021	0,036
Migration Background = [2] Direct Migration Background	-0,077	0,000	-0,085	0,000
Marital Status = [1] Married, living together	0,097	0,000	0,095	0,000
Region East West Germany= [22] East Germany	-0,107	0,000	-0,103	0,000
Experience Proxys *(Domestic engagement)*				
Housework per week	-0,001	0,815	-0,003	0,364
Childcare per week	0,013	0,000	0,013	0,000
Gender Wage Gap *(Base Category = Female)*				
Sex = [1] Male	0,030	0,000	0,024	0,004
R	,700[a]		,698[a]	
R Square	0,490		0,487	
Adjusted R Square	0,489		0,485	
N	13720		12473	

Table 2 Regression analysis (own illustration)

The first observation would be that the overall log of wages has seen a slight decline in 2020 when compared to 2019, which would correspond to the aggregate shock the labor market has endured due to the Covid-19 pandemic. Adhering to the Mincer Type Wage Equation, the first characteristics to be evaluated are part of the human capital factors. Similar to the results found by (Goldin 2022), it becomes evident that education, especially mid and top tier level education, have gained a stronger positive correlation to the log of wages. A possible explanation would be that higher education usually yields more office-type jobs which, during the Covid-19 pandemic, would be more prone to be moved into a teleworking arrangement. This would likely sustain jobs while lower-education jobs might be endangered to layoffs and thus forgone income. A similar result has been issued by a 2020 paper, that has clustered their sample in the Netherlands into two groups, one consisting of tertiary educated workers, thus academics, where less presence in terms of hours is prevalent. Except for a few outliers, there are relatively few professions in this cluster which are to be considered "essential" by the government. The other cluster, which would be represented by the base category (low education) is characterized by high volumes of manual, presential work that often involves services with close contact to clients as well as essential work, thus unfit for a change towards home office (Gaudecker et al. 2020).

Addressing the working experience sector of the human capital equation, there appear to be only slight changes. As expected, full-time working experience as well as firm tenure have a positive relation to income, while unemployment diminishes current as well as future earnings. It appears however, that being considered a full-time employee or holding a position that qualifies as such increases wage opportunity in 2020. While this effect might not be a great surprise, it still highlights how secondary factors like state-ordained benefits differ for different employment schemes. A possible relation here could be in receiving short-term wage benefits or STW, as full-time employees have access to the highest net-premiums and are also less likely to be viable to layoffs (Pusch and Seifert 2021).

Evaluating the occupations, the observations could be summarized as a white-collar effect. While the level of significance for blue-collar type occupations is inconclusive, white-collar jobs continue to earn their performers wage-premiums before and during the Covid-19 pandemic. An effect that should be taken into consideration regarding this is the connection of occupation with industry sector, E.g., the share of male workers in agricul-

ture as well as mining highly currently outnumbers female participants. If women do work in these occupations, they are more likely to handle backoffice tasks instead of performing actual physical labor, which in turn are more likely to be apt for teleworking. According to a study, there already was a much higher share of women in teleworkable occupations even before Covid-19 broke out. This "hidden" characteristic suddenly became a huge factor when staying at home became mandatory, giving women somewhat of an edge on the labor market (Sostero et al. 2020).

As for industry, there are again various developments to take into consideration. For example, the food and accommodation sector has been among the worst industries in 2019 to be employed in relation to wage earning capabilities. This position has only worsened in 2020 and of all the industries that have been presented in this model, accommodation and food takes the bottom step of the ladder in terms of income. This has likely been accelerated by the focus of the public and the WHO on accommodation and food enterprises as potential hotspots for contagion, which placed these businesses under high scrutiny and thus made it more difficult for employers and employees to conduct viable business, leading to layoffs and pay cuts (World Health Organization 2020).

Finance, insurance, and real estate has maintained its leading position in term of positive relation to income, even though the sector has suffered a small setback in the strength of the effect.

In firm size, the changes in the coefficients show the expected shift towards the top, as the smallest employers have the highest responsiveness to aggregate shocks and therefore, the larger the business is, the better its employees fare in times of crisis (Bell et al. 2021). Overall, the trend that can be witnessed is that even though the wage-premiums have been declining in recent years, large firms manage to protect their workers from unemployment and offer higher job security than their counterparts. Also, in initial policy responses, larger firm conglomerates were better addressed than SMEs, which in turn emphasizes the crisis effects of Covid-19 on firm size (Lin et al. 2021). While there is no significant effect on being self-employed that can be observed within this particular regression model, it is likely that more ample data would show similar constraints for self-employed workers as they are in a similar bargaining position as SMEs.

Advancing towards other control variables, the wage benefits of being a public servant instead of working in the private sector have almost halved from 2019 to 2020. Still, those

that work in the public domain in Germany fear only half the risk of aggregate pay shocks that private workers do (Bell et al. 2021). This would benefit women, as they are far more present in public servitude than their male counterparts.

As sad an analogy it may be, females and migrant workers do share a lot of labor market characteristics. Being employed in low-wage, precarious job market arrangements, with the added burden of a rise in nationalist protectionism and a temporary migratory status severely limits the wage prospects of migrant workers. As one paper puts it quite blatantly, these individuals are often welcome enough to be temporarily included in the lowest segment of the labor market, but without receiving any of the benefits that a citizenship of that same national economy would grant them (Bejan 2020). The results do mirror these sentiments, as the status of direct migrant workers has worsened in 2020.

In accordance with the "added-worker effect", being married acts as a stressed but tested safeguard for earnings. There is ample research that during times of crisis, if one partner is on the brink of losing one's job, the other will increase its labor supply, thus creating a form of household insurance against cyclical recessions (Albanesi and Kim 2021).

For the regional controls of East Germany, there has also not been any balancing development due to the crisis. East German workers stay behind their western countrymen in terms of income capabilities, an effect sustained as well due to differences in working from home opportunities, which are more prominent in urban western centers of Germany than in the poorer, more rural areas of East Germany (Irlacher and Koch 2021).

As for one of the main interests of the study, namely domestic duties as proxies for forgone work experience, there appears to be no significant relation between the hours worked per week in the household and income. The explanations for this are manyfold but are likely to be along the lines of modelling restrictions. Theory would suggest that if two people share the same observable attributes (education, experience, tenure, and occupation), but have distinct duties in the home, their wages will vary. Therefore, even after controlling for important observable factors, the salaries of workers with larger household duties should be lower than the wages of their less-burdened counterparts (Maani and Cruickshank 2009).

For housework, the regression model does not show this relationship, which might be due to the shared sample of men and women. Maani and Cruickshank (2009) find that if the model is fit on individual genders, there usually is a significant negative correlation for

women and none for men, suggesting that female wages are affected by domestic duties. Using a similar approach to create gendered regression models, there is empirical evidence that indeed women do suffer a larger penalty for housework and that the wage penalty for men doing housework has decreased during the Covid-19 pandemic.

The positive effects of childcare can also be explained by investigating a deeper layer of the variable. Maani and Cruckshank argue that workers with a higher wage usually tend to have larger families, thus creating a positive correlation between wage and childcare. Also, they postulate that childcare duties, apart from all other domestic tasks, are relatively invariant to changes in household income.

Finally, the gender variable to determine the discrimination of wages by sex show that the adjusted gender pay gap for this sample has decreased from 3% to 2,4%. While this result is to a certain extent surprising as it contradicts some of the papers cited in the theory, there are indeed good arguments which will be raised in the conclusion to explain this development.

4.7 Supplementary contemplations

To further validate the data, some additional regression models have been created to gain a deeper understanding of the linkages between certain variables.

The first point of focus was to observe how childcare and housework changed between 2019 and 2020 for each gender individually and in an isolated fashion, meaning separated from all other predictive factors that have been included in the model. For males, the effect of housework on the log hourly wage diminished almost by half in its effect, as it saw a reduction from -0,088 to -0,041 in the coefficient from 2019 to 2020. The effect of childcare increased from 0,011 to 0,019, which also signifies an improvement. The female side of the issue was more constant, where the penalty on the log hourly wage increased from -0,061 to -0,068 and the coefficient of childcare rose by 0,03 from 0,07 to 0,10 between 2019 and 2020. The conclusion, looking at these proxies isolated from all other determinants of wage, would be that men benefited more from working at home arrangements in the pandemic than women. The fact however that men reduced their penalty on housework by almost half would support the hypothesis that there could be a higher par-

ticipation of males in the near future, as they are expecting less wage losses by becoming active in the household. (Annex 1)

An additional regression model has been created for each gender, where the predictor variables that have been used in the principal analysis have been reintroduced to survey the gendered effect of housework and childcare in interaction with other determinants for wage. The results here are similar, where the penalty on housework for males has decreased from 2019 to 2020 by 0,01 from -0,024 to -0,014 while for females it has increased from -0,088 to -0,015. Childcare effect has remained more or less steady for both genders. This again would underline the suggestion that male participation in the household is less penalized in terms of wages due to the Covid-19 pandemic. The female perspective supports the assumptions made by various scholars that due the lack of external help and the merging of domestic and work sphere an extra strain has been put on women that have been taking care of the household before, as their daily routine becomes more of a juggling task between household and work responsibilities whereas before there was a clearer separation. (Annex 2)

Third, the comparison between the R-squared, meaning how well the independent variables in the models can capture the variance in the dependent variable, here the log of wages will be undertaken. It shall be executed between a model that includes the variables housework and childcare as proxies for forgone working experience and another that dismisses them. The idea is to gauge the influence of these proxy variables, as a vast part of this paper das been dedicated to highlighting them as possible clandestine drivers of gender wage inequality in the Covid-19 pandemic.

While only by a small margin, the main models that include housework as well as childcare as proxy variables do have a better R-squared value compared to the ones that exclude them. For 2019, the model that included the before mentioned proxies for forgone working experience does have an R-squared value of 0,49, which would mean that the predictive variables in the model explain 49% of the variance in the dependent variable, hence the log of hourly wages. The model that does not include them underscores this threshold with an R-squared value of 0,476 so there is a difference of the explained variance of around 1,5%.

For 2020, the year of the Covid-19 pandemic, the full model does still present an R-squared value of 0,487, while the comparison regression does not change from before,

maintaining a level of 0,476. This would support the assumption that even though it may not have a role as large as predicted beforehand in this work, housework and childcare duties and their significance as a proxy for forgone work experience do matter to wage earing capabilities. (Annex 3)

5. Conclusion & discussion

Returning to the hypothesis stated in the methodical sections, which answer does this work provide to the question whether the gender pay gap has been reversed by the developments of the Covid-19 pandemic? Observing the data, the response would be that there has not been a negative development of the gender wage gap in Germany but the opposite, the gap has diminished between 2019 and 2020. So how does the conclusion that the gender pay gap might even have been reduced during the first months of the Covid-19 pandemic fit in with the scientific canon? Many of the papers presented in the theoretical section hint towards a disastrous dynamic for female earnings that was to be expected with the onset of the Covid-19 pandemic. These papers were however published during a timeframe where reliable data was still rare and thus painted a much darker picture than what reality had in store. Newer research that has been conducted with more hindsight, shows that the effects are much more ambiguous as well as temporal than the initial expectations led on. For example, it was discovered that overall, men in the UK might have faced a higher shock in terms of earnings, despite the extensive research demonstrating that the crisis had a disproportionate impact on female workers. The observation was made by a 2021 paper, appropriately titled" This time is not so different", where a higher male wage penalty due to the crisis has been described (Bell et al. 2021). In addition, little gender difference were observed in the Covid-19 recession's employment effects in the UK, using longitudinal census data (Bell, B., Codreanu, M., & Machin, S 2020).

Revisiting the arguments brought forth in the theoretical section, there are even arguments that give support to this counterfactual. Gender disparities in 2020 were likely unaffected by the pandemic, thus continuing the trend of a diminishing the gender wage gap. While parenthood might have had a significant role in the cyclical increases in gender disparities, as women who were raising children saw a significant reduction in their employment rate and work hours, as well as certain gender segregation trends in the most affected indus-

tries, these effects were likely offset by contrary developments. As telework and educational returns increased during the epidemic, the greater inclination of women to work from home and their higher levels of education might have prevented the gender wage gap from widening and might even reverse it in the long term (Tverdostup 2021). The findings point to only brief oscillations rather than a systematic widening of gender inequalities. However, labor market repercussions for mothers of small children and women working in the Covid-19-affected industries may continue longer than the epidemic, thereby escalating gender disparity over time (Tverdostup 2021). In addition, prior to the virus, businesses placed a high importance on some production and operational hours that benefited male workers, encouraging employees to remain late or work on the weekends as a result. However, Covid-19 has forced businesses to be more adaptive to the time and availability of their employees. The advantages appear for the gender pay gap on two levels: Men are better able to work from home and play a bigger role in childcare, giving women more time and opportunities to work, and second, gender norms in the workplace will be pushed farther towards equality, similar to the events during and after World War 2 (LaSalle 2021). While evidence from the rest of the world suggests that the worries of a worsening of the gender pay gap may be justified, evidence from the EU and especially Germany shows that gender differences in labor market changes due to Covid-19 have been relatively modest. According to aggregate data, women have not fared worse than men when it comes to changes in employment, unemployment, and economic inactivity rates (Nivakoski and Mascherini 2021). This is especially true for the case of Germany, where a rather social than neoliberal labor market provides an apt safety-blanket for workers that helps them to sustain their income (Moehring et al. 2021).

Essentially, the results can be hinged upon two dynamics. The Covid-19 pandemic has created, though involuntary, a social experiment as it coupled a health crisis with an economic crisis. This experiment has simultaneously increased the demand for unpaid work substantially while diminishing the demand for paid work. It has enabled men to spend more time in the household, quadrupling their workload in domestic tasks thanks to home office arrangements. Due to their presence in public, healthcare as well as front-line jobs, women's employment situation has been less disruptied and has been cushioned by short-time work arrangements (İlkkaracan and Memiş 2021). In addition, during the pandemic, around 70% of essential workers in Germany have been female, while making up only

30% of the self-employed, a group that was among the most likely to lose employment (Hipp and Bünning 2021).

This reasoning would be along the lines of Claudia Goldin (2014) who argues that there has already been a great convergence in many fields that drive gender wage gaps but that the final piece of the puzzle would be a flexibilization of working hours for both genders. Reducing or even removing the premium on the necessity to be present afterhours is one threshold that the changes in labor market arrangements have likely accomplished. Thus, the Covid-19 pandemic might indeed have acted as a "big leveler", opening the doors to more flexible working arrangements for men and women that allow for an equal partition between paid and unpaid work between both genders. It might even be compared to a Solow-poverty trap, where an exogenous increase in technology, institutional change or labor force reduction provides a solution to break out of a deficit equilibrium (LaSalle 2021).

The findings of this paper unearth a mixture of patterns of societal change, some diminishing the gender wage gap, others magnifying it. Both developments are plausible from a theoretical standpoint. It should be taken into account that the methodical approach of using a sample for data evaluation, especially a quantitative approach, will never be able to tell the full story. To create a deeper understanding, it would be necessary to evaluate individual cases, considering the combination of factors among heterogenous individuals. This, coupled with the necessary separation of short-term and long-term effects highlights the need for a continuous assessment of the situation and a propensity for ongoing research on this topic to draw a final conclusion how the gender pay gap has changed, once the "dust has settled".

It is beyond doubt that the Covid-19 pandemic has had an immense effect on gender wage equality, most likely the biggest since World War 2. In accordance with other recessions, this might have created a window of opportunity, where if reinforcing policy-measures are implemented, the advances made towards equality might be manifested into long-term improvements. The changes brought about by the Covid-19 pandemic might well a defining moment of the century in relation to gender equality, and if properly addressed, could be the "big push" society needed to finally address a discriminatory status quo that has affected 50% of the working population since the creation of the labor market.

5.1 Policy implications and limitations

While the results of this work do hint at a narrowing of the gender wage gap, forthgoing the matter should continuously be viewed in an ambivalent manner. There are opposing forces simultaneously at work, both with the power to change the situation of female earnings for the better or the worse. The empirical work done in this paper does merely represent a snapshot of the actual situation and is restricted to the sampling technique and thus limitations of the data source, hence the SOEP. The selection, wrangling and evaluation of the data by the author is also unlikely to be free of any bias, both in terms of theoretical assumptions as well as methodical approaches that influenced the outcome of the study. While conducting the regression, a necessity to dive deeper into the different layers of data and the heterogenous combination of incoming predicting factors between different individuals could be identified as possible improvements for further research. While a quantitative analysis provides a macroeconomic perspective over the income situation of different groups, the composition of the individual earning history does have a strong effect on the wage-earning capabilities but is difficult to observe in large samples. The results derived in the regression should therefore be seen as a trend rather than a definitive direction and continuous evaluation and research on the gender wage gap is necessary to actually determine how the Covid-19 pandemic has featured into the development of the gender wage gap.

The implications for society and especially policymaking remain untouched by these limitations though, irrespective of the final development of the gender wage gap. The Covid-19 pandemic, due to it's transformative power, has created a window of opportunity for female wage equality. What has been shown in the research, unrelated whether the argumentation tried to prove a narrowing or widening of the gender wage gap, is that certain structural differences in paid and unpaid work still pose as the main determinants of wage inequality. Having these barriers exposed by the external shock that society has taken should be seen as clear indication that policymaking must address these final thresholds of inequality. Maintaining the flexibility that female workers have gained due to working from home arrangements, while incentivizing a more equal share of unpaid domestic work and child-rearing and reducing the premium that male earners receive by their over-

presence in the office would go a long way to eradicating structural inequality. Inaction or ignorance to the exposed hardships of women could do quite the opposite and the failure to take action now could manifest the remaining gender wage gap for the years to come. In parallel to the results of this work, policymaking should be a two-pronged approach. Bolstering the progress made for female wage earning while diminishing the final barriers to income equality could result in taking advantage of the dire situation that the Covid-19 pandemic has presented us with and actually make a positive contribution to society.

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Appendix

Disclaimer:

Due to the data being supplied in German, some of the variables do still have their original German nametag.

- **Annex - 1 – Domestic task regression isolated**

Variables Entered/Removed[a,b,c]

Model	Variables Entered	Variables Removed	Method
1	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020][d]	.	Enter

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

c. Models are based only on cases for which Geschlecht = [1] maennlich

d. All requested variables entered.

Model Summary[a]

Model	R Geschlecht = [1] maennlich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,119[b]	,014	,014	,56634

a. Erhebungsjahr = 2019,00

b. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

ANOVA[a,b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39,562	2	19,781	61,673	,000[d]
	Residual	2774,389	8650	,321		
	Total	2813,951	8652			

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

c. Selecting only cases for which Geschlecht = [1] maennlich

d. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
1	(Constant)	2,987	,009		338,679	,000
	Hausarbeit Std./Werktag [1992-2020]	-,088	,008	-,119	-11,037	,001
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,011	,004	,030	2,807	,000

Erhebungsjahr = 2020,00

Variables Entered/Removed[a,b,c]

Model	Variables Entered	Variables Removed	Method
1	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020][d]	.	Enter

a. Erhebungsjahr = 2020,00

b. Dependent Variable: Log_hourly_wage

c. Models are based only on cases for which Geschlecht =
[1] maennlich
d. All requested variables entered.

Model Summary[a]

Model	R Geschlecht = [1] maennlich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,074[b]	,006	,005	,55896

a. Erhebungsjahr = 2020,00
b. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

ANOVA[a,b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15,261	2	7,631	24,422	,000[d]
	Residual	2752,904	8811	,312		
	Total	2768,165	8813			

a. Erhebungsjahr = 2020,00
b. Dependent Variable: Log_hourly_wage
c. Selecting only cases for which Geschlecht = [1] maennlich
d. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig
1	(Constant)	2,942	,010		305,332	,000
	Hausarbeit Std./Werktag [1992-2020]	-,041	,008	-,056	-5,221	,020
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,019	,004	,055	5,137	,000

Variables Entered/Removed[a,b,c]

Model	Variables Entered	Variables Removed	Method
1	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020][d]	.	Enter

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

c. Models are based only on cases for which Geschlecht = [2] weiblich

d. All requested variables entered.

Model Summary[a]

Model	R Geschlecht = [2] weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,133[b]	,018	,017	,50716

a. Erhebungsjahr = 2019,00

b. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

ANOVA[a,b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37,228	2	18,614	72,368	,000[d]
	Residual	2069,814	8047	,257		
	Total	2107,043	8049			

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

c. Selecting only cases for which Geschlecht = [2] weiblich

d. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

Coefficients[a,b,c]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,857	,010	-,136	284,442	,000
	Hausarbeit Std./Werktag [1992-2020]	-,061	,005	,043	-11,986	,003
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,007	,002	,043	3,805	,000

Erhebungsjahr = 2020,00

Variables Entered/Removed[a,b,c]

Model	Variables Entered	Variables Removed	Method
1	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020][d]	.	Enter

a. Erhebungsjahr = 2020,00

b. Dependent Variable: Log_hourly_wage

c. Models are based only on cases for which Geschlecht = [2] weiblich

d. All requested variables entered.

Model Summary[a]

Model	R Geschlecht = [2] weiblich (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,145[b]	,021	,021	,50408

a. Erhebungsjahr = 2020,00

b. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

ANOVA[a,b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44,000	2	22,000	86,581	,000[d]
	Residual	2035,587	8011	,254		
	Total	2079,587	8013			

a. Erhebungsjahr = 2020,00

b. Dependent Variable: Log_hourly_wage

c. Selecting only cases for which Geschlecht = [2] weiblich

d. Predictors: (Constant), Kinderbetreuung, Mo.-Fr., Stunden [1992-2020], Hausarbeit Std./Werktag [1992-2020]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,894	,011		272,093	,000
	Hausarbeit Std./Werktag [1992-2020]	-,068	,005	-,146	-12,811	,002
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,010	,002	,067	5,904	,000

➢ Annex - 2 – Domestic task gendered effects regression

Coefficients[a,b,c]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,387	,028		86,240	,000
	Hausarbeit Std./Werktag [1992-2020]	-,008	,005	-,018	-1,733	,083
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,007	,001	,052	5,096	,000

	Education_Intermediate	,062	,013	,070	4,648	,000
	Education_High	,203	,016	,210	12,381	,000
	Arbeitsmarkterfahrung Vollzeit	,004	,001	,102	8,441	,000
	Arbeitsmarkterfahrung Arbeitslos	-,011	,002	-,059	-5,779	,000
	Dauer der Betriebszugehörigkeit	,008	,000	,197	16,861	,000
	Full_time_Employment	-,001	,010	-,001	-,072	,942
	Occ_one_digit=Managerial	,475	,028	,225	16,964	,000
	Occ_one_digit=Professionals	,481	,023	,424	20,526	,000
	Occ_one_digit=Technical, Assistant Professions	,274	,020	,291	13,434	,000
	Occ_one_digit=Clerial workers	,124	,020	,127	6,351	,000
	Occ_one_digit=Skilled agricultural	,029	,079	,004	,368	,713
	Occ_one_digit=Trades	,035	,035	,011	1,005	,315
	Occ_one_digit=Plant , Machine, Mining	,024	,038	,007	,645	,519
	Nace2_One_digit=Agriculture,Forestry, Mining	-,173	,054	-,035	-3,202	,001
	Nace2_One_digit=Energy, Water, Waste	,057	,048	,012	1,181	,238
	Nace2_One_digit=Construction	-,070	,037	-,020	-1,900	,057
	Nace2_One_digit=Trade	-,142	,019	-,102	-7,488	,000
	Nace2_One_digit=Transport, Information. Communication	-,056	,029	-,021	-1,940	,052
	Nace2_One_digit=Accomodation, Food	-,285	,028	-,116	-10,315	,000
	Nace2_One_digit=Finance, Insurance, Real Estate	,010	,021	,006	,466	,641
	Nace2_One_digit=Professional Services	-,100	,023	-,055	-4,435	,000
	Nace2_One_digit=Public Services	-,125	,017	-,139	-7,459	,000
	Nace2_One_digit=Other services	-,192	,025	-,091	-7,789	,000
	pgallbet=[2] GE 20 LT 200	,061	,013	,057	4,641	,000

	pgallbet=[3] GE 200 LT 2000	,120	,014	,110	8,691	,000
	pgallbet=[4] GE 2000	,160	,013	,162	11,862	,000
	pgallbet=[5] Selbstaendig, ohne Mitarbeitende	-,043	,025	-,018	-1,740	,082
	pgoeffd=[1] ja	,060	,012	,062	4,934	,000
	migback=[2] direkter Migrationshintergrund	-,046	,013	-,038	-3,589	,000
	birthregion_ew=[22] Ostdeutschland	-,099	,012	-,083	-8,051	,000

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

c. Selecting only cases for which Geschlecht = [2] weiblich

Coefficients[a,b,c]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2,473	,030		83,632	,000
	Hausarbeit Std./Werktag [1992-2020]	-,015	,005	-,035	-3,129	,002
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,007	,001	,051	4,754	,000
	Education_Intermediate	,065	,014	,073	4,578	,000
	Education_High	,209	,017	,220	12,204	,000
	Arbeitsmarkterfahrung Vollzeit	,004	,001	,093	7,345	,000
	Arbeitsmarkterfahrung Arbeitslos	-,013	,002	-,070	-6,477	,000
	Dauer der Betriebszugehörigkeit	,008	,001	,186	14,918	,000
	Full_time_Employment	-,002	,010	-,002	-,188	,851
	Occ_one_digit=Managerial	,440	,030	,202	14,631	,000
	Occ_one_digit=Professionals	,452	,025	,405	18,461	,000
	Occ_one_digit=Technical, Assistant Professions	,271	,021	,291	12,612	,000
	Occ_one_digit=Clerial workers	,106	,021	,108	5,165	,000

	Occ_one_digit=Skilled agricultural	,006	,086	,001	,071	,943
	Occ_one_digit=Trades	,029	,037	,009	,776	,438
	Occ_one_digit=Plant , Machine, Mining	-,026	,039	-,008	-,653	,514
	Nace2_One_digit=Agriculture,Forestry, Mining	-,196	,060	-,040	-3,273	,001
	Nace2_One_digit=Energy, Water, Waste	,078	,050	,017	1,555	,120
	Nace2_One_digit=Construction	-,063	,041	-,017	-1,530	,126
	Nace2_One_digit=Trade	-,156	,020	-,111	-7,740	,000
	Nace2_One_digit=Transport, Information. Communication	-,067	,031	-,025	-2,174	,030
	Nace2_One_digit=Accomodation, Food	-,283	,030	-,113	-9,526	,000
	Nace2_One_digit=Finance, Insurance, Real Estate	,020	,022	,012	,887	,375
	Nace2_One_digit=Professional Services	-,120	,024	-,064	-4,915	,000
	Nace2_One_digit=Public Services	-,121	,018	-,136	-6,870	,000
	Nace2_One_digit=Other services	-,167	,026	-,082	-6,526	,000
	pgallbet=[2] GE 20 LT 200	,052	,014	,050	3,800	,000
	pgallbet=[3] GE 200 LT 2000	,101	,014	,094	7,013	,000
	pgallbet=[4] GE 2000	,160	,014	,162	11,261	,000
	pgallbet=[5] Selbstaendig, ohne Mitarbeitende	,007	,028	,003	,251	,802
	pgoeffd=[1] ja	,040	,012	,042	3,198	,001
	migback=[2] direkter Migrationshintergrund	-,057	,013	-,050	-4,404	,000
	birthregion_ew=[22] Ostdeutschland	-,097	,013	-,080	-7,437	,000

a. Erhebungsjahr = 2020,00

b. Dependent Variable: Log_hourly_wage

c. Selecting only cases for which Geschlecht = [2] weiblich

Coefficients[a,b,c]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2,510	,029		87,744	,000
	Hausarbeit Std./Werktag [1992-2020]	-,024	,006	-,037	-3,999	,000
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,015	,003	,049	5,323	,000
	Education_Intermediate	,037	,012	,037	3,093	,002
	Education_High	,190	,015	,178	12,436	,000
	Arbeitsmarkterfahrung Vollzeit	,005	,000	,130	10,826	,000
	Arbeitsmarkterfahrung Arbeitslos	-,018	,002	-,077	-7,973	,000
	Dauer der Betriebszugehörigkeit	,007	,001	,158	12,886	,000
	Full_time_Employment	,044	,016	,026	2,703	,007
	Occ_one_digit=Managerial	,505	,025	,289	20,440	,000
	Occ_one_digit=Professionals	,432	,023	,346	18,607	,000
	Occ_one_digit=Technical, Assistant Professions	,244	,021	,199	11,542	,000
	Occ_one_digit=Clerial workers	,090	,020	,068	4,421	,000
	Occ_one_digit=Skilled agricultural	,073	,046	,018	1,605	,109
	Occ_one_digit=Trades	,103	,021	,076	4,906	,000
	Occ_one_digit=Plant , Machine, Mining	,018	,022	,011	,818	,414
	Nace2_One_digit=Agriculture,Forestry, Mining	-,261	,039	-,070	-6,684	,000
	Nace2_One_digit=Energy, Water, Waste	-,023	,030	-,007	-,783	,434
	Nace2_One_digit=Construction	-,089	,018	-,052	-4,996	,000
	Nace2_One_digit=Trade	-,148	,018	-,084	-8,091	,000
	Nace2_One_digit=Transport, Information. Communication	-,190	,019	-,105	-10,058	,000
	Nace2_One_digit=Accomodation, Food	-,282	,029	-,097	-9,769	,000

	Nace2_One_digit=Finance, Insurance, Real Estate	,068	,020	,036	3,471	,001
	Nace2_One_digit=Professional Services	-,151	,021	-,075	-7,274	,000
	Nace2_One_digit=Public Services	-,146	,018	-,116	-8,226	,000
	Nace2_One_digit=Other services	-,219	,029	-,075	-7,669	,000
	pgallbet=[2] GE 20 LT 200	,056	,014	,049	4,127	,000
	pgallbet=[3] GE 200 LT 2000	,140	,015	,115	9,467	,000
	pgallbet=[4] GE 2000	,216	,014	,200	15,099	,000
	pgallbet=[5] Selbstaendig, ohne Mitarbeitende	-,034	,025	-,014	-1,391	,164
	pgoeffd=[1] ja	,001	,016	,001	,062	,950
	migback=[2] direkter Migrationshintergrund	-,098	,012	-,084	-7,960	,000
	birthregion_ew=[22] Ostdeutschland	-,137	,013	-,098	-10,288	,000

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

c. Selecting only cases for which Geschlecht = [1] maennlich

Coefficients[a,b,c]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2,484	,028		87,440	,000
	Hausarbeit Std./Werktag [1992-2020]	-,014	,006	-,022	-2,343	,019
	Kinderbetreuung, Mo.-Fr., Stunden [1992-2020]	,013	,003	,044	4,689	,000
	Education_Intermediate	,036	,012	,036	2,929	,003
	Education_High	,192	,015	,185	12,668	,000
	Arbeitsmarkterfahrung Vollzeit	,005	,000	,126	9,856	,000
	Arbeitsmarkterfahrung Arbeitslos	-,014	,002	-,064	-6,508	,000
	Dauer der Betriebszugehörigkeit	,007	,001	,165	12,875	,000
	Full_time_Employment	,073	,016	,043	4,464	,000

	Occ_one_digit=Managerial	,521	,026	,272	20,254	,000
	Occ_one_digit=Professionals	,439	,022	,368	19,531	,000
	Occ_one_digit=Technical, Assistant Professions	,269	,021	,223	12,902	,000
	Occ_one_digit=Clerial workers	,094	,020	,074	4,755	,000
	Occ_one_digit=Skilled agricultural	,124	,047	,030	2,665	,008
	Occ_one_digit=Trades	,102	,021	,075	4,878	,000
	Occ_one_digit=Plant , Machine, Mining	,040	,022	,025	1,846	,065
	Nace2_One_digit=Agriculture,Forestry, Mining	-,277	,040	-,076	-6,940	,000
	Nace2_One_digit=Energy, Water, Waste	,024	,031	,007	,759	,448
	Nace2_One_digit=Construction	-,036	,018	-,021	-1,956	,051
	Nace2_One_digit=Trade	-,143	,019	-,081	-7,634	,000
	Nace2_One_digit=Transport, Information. Communication	-,180	,018	-,109	-9,846	,000
	Nace2_One_digit=Accomodation, Food	-,311	,030	-,106	-10,427	,000
	Nace2_One_digit=Finance, Insurance, Real Estate	,053	,019	,030	2,746	,006
	Nace2_One_digit=Professional Services	-,144	,021	-,073	-6,819	,000
	Nace2_One_digit=Public Services	-,120	,017	-,098	-6,847	,000
	Nace2_One_digit=Other services	-,187	,029	-,064	-6,467	,000
	pgallbet=[2] GE 20 LT 200	,062	,014	,055	4,513	,000
	pgallbet=[3] GE 200 LT 2000	,134	,015	,112	8,956	,000
	pgallbet=[4] GE 2000	,228	,015	,215	15,718	,000
	pgallbet=[5] Selbstaendig, ohne Mitarbeitende	-,051	,025	-,021	-2,029	,043
	pgoeffd=[1] ja	-,015	,015	-,013	-1,020	,308
	migback=[2] direkter Migrationshintergrund	-,069	,012	-,064	-5,664	,000

	birthregion_ew=[22] Ost-deutschland	-,120	,014	-,086	-8,829	,000

a. Erhebungsjahr = 2020,00

b. Dependent Variable: Log_hourly_wage

c. Selecting only cases for which Geschlecht = [1] maennlich

➢ Annex - 3 – R-squared comparison for experience proxies

Model Summary[a]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,690[b]	,476	,475	,34525

a. Erhebungsjahr = 2019,00

b. Predictors: (Constant), sex=[2] weiblich, Nace2_One_digit=Professional Services, Education_High, birthregion_ew=[22] Ostdeutschland, pgallbet=[2] GE 20 LT 200, Nace2_One_digit=Agriculture,Forestry, Mining, Nace2_One_digit=Energy, Water, Waste, Nace2_One_digit=Other services, Nace2_One_digit=Accomodation, Food, Nace2_One_digit=Finance, Insurance, Real Estate, Dauer der Betriebszugehörigkeit, Nace2_One_digit=Transport, Information. Communication, pgallbet=[5] Selbstaendig, ohne Mitarbeitende, Occ_one_digit=Managerial, Nace2_One_digit=Trade, Arbeitsmarkterfahrung Arbeitslos, Nace2_One_digit=Construction, pgallbet=[3] GE 200 LT 2000, Occ_one_digit=Technical, Assistant Professions, migback=[2] direkter Migrationshintergrund, Occ_one_digit=Plant , Machine, Mining, pgoeffd=[1] ja, Occ_one_digit=Skilled agricultural, Full_time_Employment, Occ_one_digit=Trades, Arbeitsmarkterfahrung Vollzeit, Occ_one_digit=Clerial workers, Education_Intermediate, pgallbet=[4] GE 2000, Nace2_One_digit=Public Services, Occ_one_digit=Professionals

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1320,220	31	42,588	357,286	,000[c]
	Residual	1452,902	12189	,119		
	Total	2773,122	12220			

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

c. Predictors: (Constant), sex=[2] weiblich, Nace2_One_digit=Professional Services, Education_High, birthregion_ew=[22] Ostdeutschland, pgallbet=[2] GE 20 LT 200, Nace2_One_digit=Agriculture,Forestry, Mining, Nace2_One_digit=Energy, Water, Waste, Nace2_One_digit=Other services, Nace2_One_digit=Accomodation, Food, Nace2_One_digit=Finance, Insurance, Real Estate, Dauer der Betriebszugehörigkeit, Nace2_One_digit=Transport, Information. Communication, pgallbet=[5] Selbstaendig, ohne Mitarbeitende, Occ_one_digit=Managerial, Nace2_One_digit=Trade, Arbeitsmarkterfahrung Arbeitslos, Nace2_One_digit=Construction, pgallbet=[3] GE 200 LT 2000, Occ_one_digit=Technical, Assistant Professions, migback=[2] direkter Migrationshintergrund, Occ_one_digit=Plant , Machine, Mining, pgoeffd=[1] ja, Occ_one_digit=Skilled agricultural, Full_time_Employment, Occ_one_digit=Trades, Arbeitsmarkterfahrung Vollzeit, Occ_one_digit=Clerial workers, Education_Intermediate, pgallbet=[4] GE 2000, Nace2_One_digit=Public Services, Occ_one_digit=Professionals

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2,514	,018		136,473	,000
	Education_Intermediate	,046	,009	,049	5,190	,000
	Education_High	,192	,011	,187	17,298	,000
	Arbeitsmarkterfahrung Vollzeit	,004	,000	,116	13,152	,000
	Arbeitsmarkterfahrung Arbeitslos	-,015	,001	-,071	-10,262	,000
	Dauer der Betriebszugehörigkeit	,008	,000	,175	20,976	,000
	Full_time_Employment	,005	,008	,004	,562	,574
	Occ_one_digit=Managerial	,513	,018	,270	27,970	,000
	Occ_one_digit=Professionals	,467	,016	,387	28,406	,000
	Occ_one_digit=Technical, Assistant Professions	,269	,015	,252	18,465	,000
	Occ_one_digit=Clerial workers	,113	,014	,100	8,035	,000
	Occ_one_digit=Skilled agricultural	,073	,039	,015	1,901	,057
	Occ_one_digit=Trades	,109	,017	,065	6,500	,000

	Occ_one_digit=Plant , Machine, Mining	,030	,018	,015	1,659	,097
	Nace2_One_digit=Agriculture,Forestry, Mining	-,239	,032	-,057	-7,555	,000
	Nace2_One_digit=Energy, Water, Waste	-,008	,025	-,002	-,302	,763
	Nace2_One_digit=Construction	-,080	,016	-,038	-5,115	,000
	Nace2_One_digit=Trade	-,158	,013	-,100	-12,346	,000
	Nace2_One_digit=Transport, Information. Communication	-,162	,016	-,078	-10,304	,000
	Nace2_One_digit=Accomodation, Food	-,299	,020	-,111	-15,158	,000
	Nace2_One_digit=Finance, Insurance, Real Estate	,029	,014	,016	2,058	,040
	Nace2_One_digit=Professional Services	-,138	,015	-,071	-9,171	,000
	Nace2_One_digit=Public Services	-,144	,012	-,143	-12,533	,000
	Nace2_One_digit=Other services	-,219	,018	-,088	-11,920	,000
	pgallbet=[2] GE 20 LT 200	,059	,009	,053	6,281	,000
	pgallbet=[3] GE 200 LT 2000	,131	,010	,112	12,955	,000
	pgallbet=[4] GE 2000	,190	,010	,181	19,249	,000
	pgallbet=[5] Selbstaendig, ohne Mitarbeitende	-,038	,018	-,015	-2,163	,031
	pgoeffd=[1] ja	,034	,010	,031	3,482	,000
	migback=[2] direkter Migrationshintergrund	-,075	,009	-,063	-8,537	,000
	birthregion_ew=[22] Ostdeutschland	-,116	,009	-,088	-12,812	,000
	sex=[2] weiblich	-,083	,008	-,087	-10,632	,000

a. Erhebungsjahr = 2019,00

b. Dependent Variable: Log_hourly_wage

Model Summary[a]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,690[b]	,476	,475	,34001

a. Erhebungsjahr = 2020,00

b. Predictors: (Constant), sex=[2] weiblich, Education_High, Nace2_One_digit=Professional Services, birthregion_ew=[22] Ostdeutschland, pgallbet=[3] GE 200 LT 2000, Nace2_One_digit=Agriculture,Forestry, Mining, Nace2_One_digit=Energy, Water, Waste, Nace2_One_digit=Other services, Nace2_One_digit=Accomodation, Food, Dauer der Betriebszugehörigkeit, Occ_one_digit=Managerial, Nace2_One_digit=Finance, Insurance, Real Estate, pgallbet=[5] Selbstaendig, ohne Mitarbeitende, Nace2_One_digit=Transport, Information. Communication, Arbeitsmarkterfahrung Arbeitslos, Nace2_One_digit=Trade, Nace2_One_digit=Construction, Occ_one_digit=Technical, Assistant Professions, pgallbet=[2] GE 20 LT 200, Occ_one_digit=Plant , Machine, Mining, pgoeffd=[1] ja, migback=[2] direkter Migrationshintergrund, Full_time_Employment, Occ_one_digit=Trades, Occ_one_digit=Skilled agricultural, Occ_one_digit=Clerial workers, Arbeitsmarkterfahrung Vollzeit, Education_Intermediate, pgallbet=[4] GE 2000, Nace2_One_digit=Public Services, Occ_one_digit=Professionals

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1180,309	31	38,074	329,350	,000[c]
	Residual	1298,820	11235	,116		
	Total	2479,128	11266			

a. Erhebungsjahr = 2020,00

b. Dependent Variable: Log_hourly_wage

c. Predictors: (Constant), sex=[2] weiblich, Education_High, Nace2_One_digit=Professional Services, birthregion_ew=[22] Ostdeutschland, pgallbet=[3] GE 200 LT 2000, Nace2_One_digit=Agriculture,Forestry, Mining, Nace2_One_digit=Energy, Water, Waste, Nace2_One_digit=Other services, Nace2_One_digit=Accomodation, Food, Dauer der Betriebszugehörigkeit, Occ_one_digit=Managerial, Nace2_One_digit=Finance, Insurance, Real Estate, pgallbet=[5] Selbstaendig, ohne Mitarbeitende, Nace2_One_digit=Transport, Information. Communication, Arbeitsmarkterfahrung Arbeitslos, Nace2_One_digit=Trade, Nace2_One_digit=Construction, Occ_one_digit=Technical, Assistant Professions, pgallbet=[2] GE 20 LT 200, Occ_one_digit=Plant , Machine, Mining, pgoeffd=[1] ja, migback=[2] direkter Migrationshintergrund, Full_time_Employment, Occ_one_digit=Trades, Occ_one_digit=Skilled agricultural, Occ_one_digit=Clerial workers, Arbeitsmarkterfahrung Vollzeit, Education_Intermediate, pgallbet=[4] GE 2000, Nace2_One_digit=Public Services, Occ_one_digit=Professionals

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2,543	,019		135,354	,000
	Education_Intermediate	,047	,009	,050	5,089	,000
	Education_High	,197	,011	,197	17,484	,000
	Arbeitsmarkterfahrung Vollzeit	,004	,000	,109	11,816	,000
	Arbeitsmarkterfahrung Arbeitslos	-,014	,001	-,070	-9,685	,000
	Dauer der Betriebszugehörigkeit	,007	,000	,174	19,762	,000
	Full_time_Employment	,013	,008	,013	1,551	,121
	Occ_one_digit=Managerial	,500	,019	,246	25,677	,000
	Occ_one_digit=Professionals	,454	,017	,389	27,495	,000
	Occ_one_digit=Technical, Assistant Professions	,278	,015	,264	18,764	,000
	Occ_one_digit=Clerial workers	,105	,014	,095	7,462	,000
	Occ_one_digit=Skilled agricultural	,100	,041	,020	2,475	,013
	Occ_one_digit=Trades	,098	,017	,059	5,696	,000
	Occ_one_digit=Plant , Machine, Mining	,034	,018	,017	1,850	,064
	Nace2_One_digit=Agriculture,Forestry, Mining	-,263	,033	-,064	-7,917	,000
	Nace2_One_digit=Energy, Water, Waste	,037	,026	,010	1,382	,167
	Nace2_One_digit=Construction	-,039	,016	-,018	-2,349	,019
	Nace2_One_digit=Trade	-,159	,013	-,101	-11,917	,000
	Nace2_One_digit=Transport, Information. Communication	-,157	,016	-,081	-10,094	,000
	Nace2_One_digit=Accomodation, Food	-,310	,021	-,113	-14,903	,000
	Nace2_One_digit=Finance, Insurance, Real Estate	,029	,014	,017	2,023	,043
	Nace2_One_digit=Professional Services	-,143	,016	-,074	-9,056	,000

	Nace2_One_digit=Public Services	-,129	,012	-,130	-10,936	,000
	Nace2_One_digit=Other services	-,185	,019	-,076	-9,865	,000
	pgallbet=[2] GE 20 LT 200	,057	,010	,052	5,828	,000
	pgallbet=[3] GE 200 LT 2000	,118	,010	,103	11,352	,000
	pgallbet=[4] GE 2000	,194	,010	,188	19,123	,000
	pgallbet=[5] Selbstaendig, ohne Mitarbeitende	-,033	,019	-,013	-1,784	,075
	pgoeffd=[1] ja	,014	,010	,013	1,451	,147
	migback=[2] direkter Migrationshintergrund	-,069	,009	-,062	-7,793	,000
	birthregion_ew=[22] Ostdeutschland	-,109	,009	-,083	-11,614	,000
	sex=[2] weiblich	-,076	,008	-,081	-9,649	,000

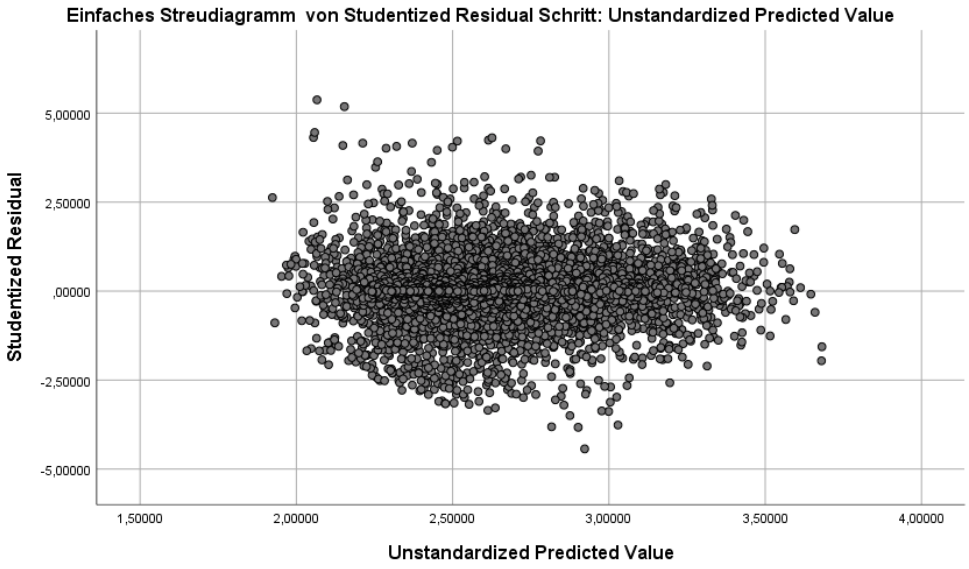
a. Erhebungsjahr = 2020,00

b. Dependent Variable: Log_hourly_wage

➢ Annex - 4 – Validation of dataset

Assumptions necessary for multiple regression:

- Independence of observations: Durbin Watson: 1,967
- Establishing linear relationship: Graph
- Testing for homoscedasticity: Graph



- Testing for multicollineratiy: No value of VIF > 10
- Checked for outliers ±3 standard deviations via casewise diagnostics. **studentized deleted residuals,** Leverage value, Cooks Distance
- Normal distribution: